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AGRICULTURAL DEVELOPMENT - EVIDENCE OF DR. WM. SAUNDERS, DIRECTOR OF THE DOMINION
EXPERIMENTAL FARMS

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Canada Agriculture and Colonization
Select Standing Cttee on, 1903

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AGRICULTURAL DEVELOPMENT

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EVIDENCE

OF

DR. WILLIAM SAUNDERS

DIRECTOR OF THE DOMINION EXPERIMENTAL FARMS

BEFORE

THE SELECT STANDING COMMITTEE

ON

AGRICULTURE AND COLONIZATION

1903

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AGRICULTURAL DEVELOPMENT

HOUSE OF COMMONS,

ROOM 34,

FRIDAY, May 15, 1903.

The Select Standing Committee on Agriculture and Colonization met here this day at 10 o'clock a.m., Mr. Douglas, Chairman, presiding.

Professor WM. SAUNDERS, Director of the Dominion Experimental Farms, attended by request and addressed the Committee as follows :—

MR. CHAIRMAN AND GENTLEMEN,—It affords me much pleasure to appear before you once more to submit for your criticism and for your information such particulars in regard to the work of the experimental farms and the general progress in agriculture as I may be able to present to you. The rapid advancement made by Canada during the past few years in the development of her agricultural resources is marvellous and the gain has been mainly along lines where growth is likely to be permanent and increasing.

During the past seven years the exports of farm produce from this country have more than doubled and now amount to over \$80,000,000 a year. The articles in which the larger part of this increase has occurred are, wheat, flour, oats, peas, cattle, pork, bacon and hams, poultry, cheese, butter and fruits.

Along these lines the resources of Canada for the extension of trade are practically unlimited. We have suitable climates, an enormous area of fertile soil and all other facilities necessary to a vast increase of our agricultural productions and we are now beginning to obtain the increase in population needed to utilize the great wealth which has long lain buried in the fertile soils of this country.

The results of the farm operations of the past year have been most encouraging. Throughout the whole of Canada, from the Atlantic to the Pacific, nearly all the more important agricultural crops have been highly satisfactory and a bountiful harvest has been gathered.

It has been my privilege during the year to see large areas of these crops in nearly all the provinces and territories of the Dominion, and I can assure you they have been most encouraging and gratifying to the people.

When we compare the condition of agriculture in Canada at present with what it was in 1884, nineteen years ago, there is great reason for thankfulness. Then farming was in a most depressed condition and a Committee of your Honourable House was appointed to inquire into the causes of this depression, and careful investigation led to the conclusion that the lack of success was not due to any fault in the climate or soil of this country nor to a lack of industry among the farmers, but to defective farming, to want of skill and knowledge in all departments. There was a lack of information as to proper preparation of the soil, the maintenance of its fertility, to a suitable rotation of crops and as to selection of the best varieties of farm crops for sowing. There was great want of a fuller knowledge regarding stock breeding and the adaptability of breeds to particular conditions. Improvements were sadly needed in connection with the manufacture of cheese and butter, also in the cultivation of suitable varieties

of fruit. There was also a deplorable lack of knowledge as to the insects and diseases from which the farmer suffers large losses in crops. Also in regard to common weeds which sometimes overrun his fields and rob him of a large proportion of the fruit of his toil.

The House of Commons promptly adopted measures with a view to remedy this sad condition. The Dominion system of experimental farms was established and work shortly begun to demonstrate which were the best methods to adopt looking to the production of the highest quality and largest quantity of the more important farm crops in all the different climates of the Dominion.

The first time I was asked to appear before this Committee was in 1887, and I have had the privilege of coming before you every year since then. I have thus had the opportunity of presenting to you annually for sixteen years some particulars relating to the measures adopted from time to time to assist farmers, and have had the benefit of your criticisms and suggestions.

At first advancement was slow, demonstrations were wanted along every line, but each year a gain more or less satisfactory was made. The provincial governments soon vied with the Dominion in efforts to assist the farmer to a better knowledge of his business. The Canadian farmer has been earnest in his desire to improve his conditions and has shown an aptitude for acquiring and utilizing practical information in all lines of farm work, and to-day we find, as a whole, no farmers better informed than Canadian farmers, and as a body none more prosperous. Sixteen years have worked a mighty change, and the results of the efforts made for the farmers' advancement have laid the foundations for a prosperous condition of agriculture, of which as yet we see only the beginning.

But we must never forget that we shall always have much to learn, and a striving for improvement in quality of product, in methods to economize the cost of production and to increase the output should never cease, and we should ever be on the search for new outlets for our productions, and be always ready to meet the wants and wishes, as far as is practicable, of those who are willing to trade with us.

Permit me to call your attention to some features of interest in connection with those portions of the helpful work connected with farming to which it has been my privilege to devote much personal attention during the past sixteen years. The reason why I propose to restrict my remarks mainly to certain special lines is that my associates on the Experimental Farm staff, all of whom have, under my direction, done excellent work, may present, as they appear before you later, the results of the work they have done, in their own way, without being anticipated by any statement of mine.

In the proper preparation of land for crop, which varies so much in different parts of the Dominion, great advancement has been made. On the western plains the adoption by the best farmers of the summer-fallowing of about one-third of their land every year now is very general. The system of fallow most approved is to plough deep, 7 to 8 inches, before the last of June, and to cultivate the surface several times during the growing season to destroy weeds. By this treatment the moisture in the soil is economized and the land largely cleaned from weeds. The crops on summer-fallow, even if the total cropping area is thus made somewhat smaller, are so bountiful that greater profits are had with less labour.

By Mr. Wilson :

Q. You are speaking now of Manitoba and the North-west Territories ?

A. Yes, of the methods in practice there.

In the east the fall ploughing of land has become almost universal. By this practice spring work is materially advanced and early sowing made practicable. The advantages had from early sowing were referred to in my evidence before you two years ago, but so important a point will bear repeating. The average of ten years' experience in early, medium and late sowing at Ottawa has shown that with wheat a delay of one week after the ground is in good condition to receive the seed has entailed a loss of

over 30 per cent, two weeks 40 per cent, three weeks nearly 50 per cent, and four weeks 56 per cent of the crop.

With oats a delay of one week has caused an average loss of over 15 per cent, two weeks 22 per cent, three weeks 32 per cent, and four weeks 48 per cent. In the case of barley a delay of one week has resulted in an average loss of 23 per cent, two weeks 27 per cent, three weeks 40 per cent, and four weeks 45 per cent. With pease the loss in the crop from delay has been less. A delay of one week has lessened the crop to the extent of four per cent, two weeks 12 per cent, three weeks 22 per cent, and four weeks 30 per cent.

The wide publication given to the results had from these experiments has led farmers to practise early sowing, and in this way crops have been improved.

BARN-YARD MANURE,—FRESH AND ROTTED.

While the mechanical condition of the soil is an important factor in crop production, its fertility is a still more vital one, hence great attention has been given in the work of the experimental farms to showing the importance of maintaining the fertility of the land, and in demonstrating how this can be done most economically and most effectively. The use of barn-yard manure is almost as old as agriculture itself, and its great usefulness in assisting crop growth was early recognized, but the proper methods of storing and handling it so as to avoid as far as is practicable waste and loss have only recently been understood. Where plenty of barn-yard manure is available little else is actually necessary since it contains all the materials required for vigorous crop growth. It has been shown by the results of experiments conducted at the Central Farm that the ploughing under of manure fresh from the barn-yard is both economical and effective. That while in the process of rotting, barn-yard manure loses more than half its weight, its effectiveness in crop production is not materially increased, and that a ton of fresh barn-yard manure ploughed under is equal to a ton of rotted manure in crop producing power. A carefully planned series of experiments conducted for 14 or 15 years has given the following average results :—

	ROTTED MANURE.		FRESH MANURE.	
	Per Acre.		Per Acre.	
	Bush.	Lbs.	Bush.	Lbs.
Wheat, average for 15 years.....	22	22	22	44
Oats, 14 years.....	51	13	55	22
Barley, 14 years.....	35	5	35	8

FERTILIZING WITH CLOVER PLOUGHED UNDER.

The ploughing under of clover has been found most effective as an additional source of fertility. It increases the store of available plant food by the addition of nitrogen obtained directly from the atmosphere. It adds also to the mineral plant food available, potash and phosphoric acid by gathering these from depths not reached by the shallower root systems of other farm crops. It also serves at a catch crop during the autumn months, retaining fertilizing material brought down by the rain, much of which would otherwise be lost. Further it supplies the soil with a large addition of humus whereby it is made more retentive of moisture, and results in a deepening and

mellowing of the soil. Humus also furnishes material in which those minute forms of germ life which act so beneficially on the soil can thrive and propagate freely.

During the past season a bulletin has been published at the Experimental Farm on the usefulness of clover as a fertilizer, prepared jointly by the Chemist of the farms, Mr. F. T. Shutt and myself. In this bulletin an account is given of the results had in increased crops from the use of clover in a large series of experiments conducted during the past four years with oats, Indian corn and potatoes. There are a number of copies of this bulletin on the table if any gentleman would like to have them. The facts submitted furnish very strong evidence of the usefulness of clover in this connection.

EXPERIMENTS IN 1902, WITH CLOVER AS A FERTILIZER.

A series of 18 plots was arranged for on one-half of which clover was sown with grain in the spring of 1901. When the clover had made good growth late in the autumn of that year it was ploughed under. In the alternate plots the same grain was sown, and at the same time, but without clover. In the spring of 1902 six of these plots were sown with Banner oats. On the three plots where clover had been sown and ploughed under, the oats yielded an average of 71 bushels 13 pounds per acre, while those sown on the adjoining plots where no clover had been used gave an average return of 61 bushels 6 pounds, a difference of 10 bushels 7 pounds per acre in favour of the plots on which clover had been grown.

On another six plots Indian corn was grown, three with clover and three without clover. In this case the variety known as Selected Leaming was used. The three plots on which the clover had been sown and turned under gave an average return of 22 tons 533 pounds per acre, while those on which no clover had been used gave only 16 tons 507 pounds per acre, a difference of 6 tons 26 pounds in favour of the plots on which clover had been used. Following the same plan, six plots were planted with potatoes; the three which had the benefit of the clover gave an average of 391 bushels 40 pounds per acre, while those on which no clover had been sown gave an average crop of 352 bushels 40 pounds, a difference of 39 bushels per acre in favour of the plots treated with clover.

A second series of plots was planned in 1902 to ascertain to what extent the good influence of the clover would be maintained in increased crop, the second year after ploughing under. In this instance, there were three trials made with six plots each, three of which were treated with clover and three without clover. The clover was sown with grain in the spring of 1900 and ploughed under in the autumn of that year. In the second year the oats on the clover ground gave an average of 20 bushels 5 pounds per acre more than on the plots where no clover had been used. The corn gave an average increase of 2 tons 187 pounds, and the potatoes an average of 13 bushels 20 pounds on the plots treated with clover. In the case of the oats there was a large increase also each year in the weight of the straw in favour of the clover plots. In this instance a part of the large increase in grain would probably be fairly attributable to the favourable season.

By Mr. Erb :

Q. Would not that apply just as much to the plots on which there was no clover turned under ?

A. No doubt, the favourable weather would be a benefit to both, but the plots having the additional fertility and more favourable conditions which the clover gives would have a decided advantage.

The increase in grain where clover had been turned under was 20 bushels 5 pounds per acre more than on those plots where the clover was not used, and this was in the second year after the turning under of the clover. Nothing had been done to the soil meanwhile; the object was to find out whether the influence of the clover was lasting.

By Mr. Cochrane :

Q. We understood that the difference was partly caused by the rain. Would not the rain have the same effect on the plots which have the clover as on those which have not ?

A. On the plots where clover had been sown two years previous, the conditions were more favourable for the growth of an oat crop than where no clover had been used, and the increase following the ploughing under of the clover the first year was a little over 10 bushels per acre. It was over 20 bushels the second year, the clover thus manifesting its influence in a more striking manner in the second year.

By Mr. Erb :

Q. This would seem to show that the clover was of more benefit the second year than the first ?

A. So it would appear in this instance, but you must remember that the year was a more favourable one for oats than the preceding season.

Q. But if the climatic conditions were more favourable the second year, it would apply as much to the plots without clover as to those that were sown with it ?

A. That might be, if the land was in the same condition, but the clover ploughed under had made the land more favourable for crop growth, which gave those plots an additional advantage over the plots where clover had not been grown.

The Indian corn gave an average increase of 2 tons 187 pounds, and the potatoes an average increase of 13 bushels 20 pounds on the plots treated with clover. These crops showed a much smaller increase than they did the first year, as the season was less favourable for them.

By Mr. Cochrane :

Q. Was that sown on land where clover had been sown on the same spring ?

A. It was sown on land where clover had been sown two years previous.

Q. Oh, yes, excuse me but what I want to find out, and I think it is important ; when you started this experiment was it from the crop of clover sown in the spring of the same year ?

A. The clover was sown in the spring with the grain.

Q. And then the crop of clover was ploughed under the next fall ?

A. Yes, and the next year nothing further was added to the soil, so that the effect of the one sowing of clover on the second crop of grain might be ascertained.

By Mr. Erb :

Q. That is, the clover was ploughed under in the fall of the same year that it was sown ?

A. In this instance the clover was sown in the spring of 1900 and ploughed under in the fall of 1900. I have given the results of the crop of 1901. Then in the spring of 1902 the same land was used for the crops referred to and the results I have given show the influence of the clover the second year after turning under.

During the five years in which these trials have been conducted the average increase in the oat crop where clover has been used has been about 9 bushels per acre. In corn there has been an average increase of over 4 tons per acre and in potatoes the difference in favour of the clover plots has been 34 bushels per acre.

RESULTS OBTAINED FROM SPECIAL EXPERIMENTS WITH FERTILIZERS.

The benefits of clover when ploughed under in increased crop have also been clearly demonstrated in another important series of experiments. I refer to the special experiments which have been carried on for the past 15 years to gain information as to the action of fertilizers and combinations of fertilizers on the more important farm

crops. The experience gained has been reported on annually for the last ten years and will probably be more or less familiar to most of the members of the Committee. There were set aside for this work 105 plots of one-tenth of an acre in five sets of 21 each. Nineteen plots in each series were treated with different fertilizers and combinations of fertilizers and the other two plots were left as check plots and no fertilizer of any sort applied to them. The same crop has been grown on this land every year, but after ten years had elapsed the fertilizers were discontinued and clover was sown with the grain and ploughed under every year. No. 3 plot in each series was one of the check plots on which 10 crops of oats had been grown in succession without application of any fertilizer whatever. The oat crop for the ten years ending with 1898 had averaged 30 bushels 23 pounds per acre, but that year the yield was only 28 bushels 8 pounds, or about $2\frac{1}{2}$ bushels below the average. With the use of clover the crops in the four subsequent years have stood as follows: In 1899, the effect of the clover was scarcely seen, the crop being 29 bushels 24 pounds. In 1900, it was 47 bushels 2 pounds. In 1901 it was 48 bushels 3 pounds, and in 1902 it was 46 bushels 11 pounds. All this time these crops were grown without giving any fertilizer or other improvement to the soil than the ploughing under of clover. During these last three years the crops averaged over 16 bushels per acre more than they had for the previous ten years, an astonishing increase, in view of the fact that oats have been grown every year on the same land for the whole period. As another illustration, I would cite plot No. 11. On this plot there were used per acre, each year for ten years, 350 pounds of mineral superphosphate, 200 pounds of nitrate of soda and 1,500 pounds of unleached wood ashes. This liberal treatment must have furnished the soil with plant food in abundance. Yet the average crop of oats under this treatment for ten years was only 36 bushels 5 pounds per acre, scarcely an average of 6 bushels more than from the unfertilized plot. After this the fertilizers were discontinued and clover grown and ploughed under each year. In 1899 the crop, which had averaged 36 bushels 5 pounds per acre for ten years, was 37 bushels 2 pounds. In 1900 45 bushels 20 pounds, in 1901 49 bushels 29 pounds, and in 1902 the yield was 51 bushels 6 pounds per acre, an average increase for the past three years of 9 bushels 30 pounds per acre.

By Mr. Erb :

Q. Was the same variety of oats sown every year ?

A. The same variety has usually been sown for a number of years. The varieties have been changed twice in fifteen years. A variety known as English White was used the first year, for the next four years the Prize Cluster was sown, and for the past nine years the Banner has been used. The particulars of these changes have been given in the reports each year.

Q. Whenever a different variety was sown, I suppose, a variety was selected which had proved itself to be more prolific ?

A. Yes, in selecting a new variety, one of the best sorts was chosen. The Banner oats have been grown for the past nine years.

By the Chairman :

Q. The continuance of one variety makes your experiment all the more valuable ?

A. We have realized that, and a variety chosen has usually been continued until it has been shown to be weak in the straw or less productive than others. Whenever a change has been made, it has been noted in the report.

By Mr. Robinson (Elgin) :

Q. What is the name of your best oat now ?

A. I think the Banner on the whole is the best variety we are growing now.

In other crops also the increase in yield following the use of clover has been very striking. In wheat, plot No. 3 had given, up to 1899, an average yield of 10 bushels 18 pounds per acre. That is a plot which never had any fertilizer whatever. With

the ploughing under of clover the yield, in 1900, was 13 bushels 45 pounds, in 1901, 17 bushels 20 pounds, and in 1902, 16 bushels 50 pounds, an average increase during these three years of 5 bushels 41 pounds per acre, being more than 50 per cent of an increase from the use of clover. In plot No. 11 of the wheat series, treated the same as plot No. 11, in the oats series, the average yield for the ten years ending with 1899, was 13 bushels 56 pounds per acre. In 1900, it was 18 bushels 20 pounds; in 1901, 16 bushels 5 pounds, and in 1902, 14 bushels and 25 pounds, an average increase of 2 bushels 20 pounds per acre.

The results were still more marked with Indian corn. This crop on plot 3, after 10 years' test, was reduced to about 2 tons per acre. With one crop of clover, turned under, the yield of Indian corn was increased to over 8 tons per acre. On plot 11 the average of 10 years was 13 tons 1,090 pounds per acre. The ploughing under of a single crop of clover raised this the following season to 26 tons 505 pounds per acre.

On field roots, the beneficial action of clover ploughed under was also very striking. The turnips grown on plot 3 with no fertilizer for the 10 years ending with 1899, averaged 6 tons 1,863 pounds per acre, with one crop of clover ploughed under the average for the two years following was 10 tons 1,560 pounds, an average increase of 3 tons 1,697 pounds per acre; more than 50 per cent.

The mangels on plot 3 had given an average to 1899, of 8 tons 1,587 pounds. The two years following the turning under of clover the crop averaged 10 tons 1,560 pounds, an increase of 2 tons per acre, or nearly 25 per cent. On nearly all these plots with all the different fertilizers used, the discontinuance of the fertilizers and the sowing of clover and ploughing under has produced a decided increase in the crop.

Such evidence I think clearly establishes the claim made for clover, that it is a most valuable addition to the soil which invariably results in an improved condition of the land and brings increased crops.

SOWING CLOVER IN THE NORTH-WEST.

By Mr. Chairman :

Q. In reference to the sowing of clover in the spring in the North-west for example would it pay to sow the clover and turn it under the first season for its beneficial effects ?

A. In our experience in the North-west the sowing of clover with grain as we do here is unsuccessful. The grain takes all the moisture out of the soil and the clover does not get a chance to thrive. To get any benefit from clover there, you must devote the season to it, and we have been trying to grow clover in place of summer fallowing, sowing clover in the spring and ploughing under in the autumn. It has been tried for three years but the soil is so rich on the prairies and contains so much surplus nitrogen that no benefit from the use of clover has yet been perceived. We hope by continuing this for ten or twelve years to demonstrate that it will result in increased crops most important in Canada. During 1902, 2,500,758 acres were devoted to oats in and experimental plots have been established at each of the western farms for this purpose.

By Mr. Wilson :

Q. It must be great waste for the farmers to bother with it ?

A. Yes, it would seem so, but the experience we are gaining for the future may be exceedingly valuable.

Q. But for farmers generally it would be of no value ?

A. There is no need of it at present, because all the plant food needed by the crops is already in the soil and is stored up there in great abundance.

COMPARATIVE RETURNS FROM VARIOUS KINDS OF OATS.

With your permission I will next speak of the Oat crop. This crop is one of the

Ontario and the yield was 106,431,439 bushels, an average of 42 bushels 6 pounds per acre which was 7 bushels 3 pounds above the average of the past twenty years.

In Manitoba the acreage devoted to oats was 725,060 and the total yield 34,478,160 bushels, an average of $47\frac{1}{2}$ bushels per acre. In all the other provinces and territories it is also an important crop.

At the experimental farms larger crops have been grown than the averages mentioned. On the experimental plots the average yield in 1903 of all the varieties tested at Ottawa has been 65 bushels 19 pounds per acre. The best twelve varieties have given an average of 80 bushels 33 pounds.

The field crops covering 56 acres in all have ranged from 55 to 61 bushels per acre.

At the Nappan experimental farm in Nova Scotia the Superintendent gives the average yield of all the varieties tested, as 90 bushels 18 pounds per acre. The field crops on new land at 46 to 55 bushels 17 pounds per acre.

At the experimental farm at Brandon, Manitoba, the average yield on experimental plots of all the different sorts tried was 60 bushels 11 pounds; the best 12 varieties averaged 76 bushels 22 pounds.

At the experimental farm at Indian Head, N.W.T., the average of all the varieties grown was 67 bushels 30 pounds, while 12 of the best sorts gave an average of 82 bushels 28 pounds per acre.

The field crops covering 53 acres in all, averaged 76 bushels 32 pounds per acre, which was about 9 bushels more than the average of the plots, showing that sometimes the field crops will go above the average of the experimental plots, but most commonly we find the experimental plots give the larger yields because as they have paths between them they have a larger margin in proportion to the area covered and may be expected to give a little more.

Four acres of Goldfinder averaged 89 bushels 17 pounds per acre. Nine and a quarter acres of Banner averaged 87 bushels. Five acres of Wide-awake 87 bushels, and 6 acres of Tartar King, one of the new English sorts we have been introducing of late, gave at Indian Head an average of 85 bushels per acre.

At the British Columbia experimental farm at Agassiz, the average of all the varieties tested was 63 bushels 10 pounds. The best 12 sorts gave an average of 73 bushels and 4 pounds per acre. The average given by the whole of the varieties tested on all the experimental plots at all the farms in 1902, was 70 bushels 4 pounds per acre, showing that the average of the crops of oats at the experimental farms is very much larger than the average obtained by the farmers in any of the provinces.

About 60 varieties of oats brought from many different countries have been under trial each year for the past seven or eight years in uniform trial plots at all the experimental farms. During the past winter the records of all of these have been gone carefully over and all those which have fallen below a certain high standard of average productiveness, have been dropped from the list, thus reducing the number under cultivation. This will bring more prominently before the farmers of Canada those sorts which we have found to be most highly productive.

By the Chairman :

Q. Do you retain the Improved Ligowo ?

A. Yes.

Q. It does remarkably well with us ?

A. It has also given good satisfaction in many other parts of the country.

THE BANNER OAT IN CANADA AND IN SCOTLAND.

As the result of eight years' trial on experimental plots the Banner oat still stands at the head of all the varieties tested with the wonderful average crop for the whole period of 76 bushels 29 pounds, taking all the experimental farms into account.

It has also done remarkably well in field crops, and during the past eight years has averaged in all the field crops grown at all the experimental farms 69 bushels 13 pounds per acre, showing that in field culture it has come very close to the yield obtained on the experimental plots. In Great Britain the Banner oat received from Canada continues to attract much attention. In my evidence before this committee in 1900, I mentioned that samples of Banner and other promising oats had been sent in 1899 to Prof. Patrick Wright, principal of the Agricultural College in Glasgow, Scotland. These were forwarded in response to a request from him for samples of the best sorts of oats cultivated in Canada to test alongside of the best varieties grown in Scotland. Prof. Wright's reports show that from the outset the Banner oat took a leading position among the many varieties he was growing, and the next year a request came from him for twelve bushels for further trial, and in the year following for fifty bushels more. These were distributed among a number of leading farmers in different parts of Scotland, and the reports published were so favourable that a great demand was created for the seed and several large orders were received by seed firms in Canada last year for these oats for use in Great Britain. In a recent letter from Prof. Wright, he says: 'It may interest you to know that the Banner oat has now taken an assured position among the oats cultivated in Britain, and has proved itself to be equal to if not better, than any other oat we have.' In a recent letter from James Bruce, who visited Canada in 1880 as one of the earlier farm delegates, he says: 'I may mention that Banner oats are being introduced from Canada into this country and the results are very satisfactory. This season I have sown fifteen acres of them.'

By Mr. Le Blanc :

Q. What is the quantity of seed used to the acre?

A. Two bushels is the quantity we use on our experimental farms, and that, I think, is about the quantity of seed generally used.

Another of the varieties sent to Scotland from here is also attracting notice. This is the 'Wide-awake.' Of this variety in a recent letter Prof. Wright speaks as follows: 'In our last season's trials a remarkably good result is shown in our tables by the 'Wide-awake' oat of which we also got the original seed from you. It has done so well that I am writing you now to ask if you would be good enough to get sent to me without delay twenty quarters (160 bushels) to be used as seed this season.' I could not get that quantity, but succeeded in getting fifty bushels, which were sent in good time for sowing. In a letter of March 17, he says: 'If this oat does as well with us next year as last, it is also likely with the Banner to pass into general cultivation here. It is gratifying to know that we are thus helping farmers in the mother country with Canadian varieties of a very productive and valuable character.'

CONSIDERATIONS IN ESTIMATING THE VALUE OF AN OAT.

In estimating the value of an oat the relative weight of kernel and hull must be considered. This will vary with the variety and with the weight per bushel of the sample. The lighter the weight per bushel the larger is the proportion of hull. In a very light sample weighing less than 20 pounds to the bushel the proportion of hull has been found to be over 50 per cent, whereas the same variety of the standard weight would only have about 36 per cent of hull. I have some samples here of oats with the hulls on and some that are free from the hull from which you will see how the different varieties vary, in different seasons in plumpness, and hence in the proportion of kernel which they produce. Here is a specimen of the Tartar King, which has a very plump kernel.

By Mr. Chairman :

Q. The proportion would differ very much owing to the lateness in sowing?

A. Yes, when sown very late the kernel is apt to be light.

The Banner is generally regarded as a thick hulled oat, but in our experience it can only be considered as medium in this respect. The sample before you from Indian Head weighs $44\frac{1}{2}$ pounds per bushel and has 29·72 per cent of hull. This has been put through a barley scutcher which has rubbed off the awns and a little of the hull at the tip which increased the weight per measured bushel over 2 pounds, as the oats when so treated lie closer together. This is the way we prepared them for the seed distribution this spring. The proportion of hull is also reduced by this process about 2 per cent. The same oat grown at Ottawa and similarly treated, and weighing after passing through the scutching machine $42\frac{1}{2}$ pounds per bushel had 28·63 per cent of hull. An untrimmed sample of Banner weighing $34\frac{1}{2}$ pounds per bushel had $31\frac{1}{2}$ per cent of hull. Of the oats we have been distributing this season the Improved Ligowo has the smallest proportion of hull.

The CHAIRMAN.—I would like to state to the Committee that a few years ago my son and I got samples from the Farm here, and last year we had 70 acres, and the best crop of oats we have ever had on our farm.

By Mr. Robinson (Elgin):

Q. What kind ?

The CHAIRMAN.—Improved Ligowo.

PROF. SAUNDERS.—This was grown at Indian Head and weighed $46\frac{1}{2}$ pounds per bushel.

By Mr. Wilson :

Q. Is this after the hulls are taken off or before ?

A. No, not after the hulls have been taken off but after it has been passed through a barley scutcher which rubs off the awns, and a little of the hull at the tip.

Q. These that are hulled, are marked $44\frac{1}{2}$ pounds ?

A. That is meant to indicate the weight of the oat before it was hulled.

This sample of Improved Ligowo from Indian Head which has been through the scutcher has 25·9 of hull or practically 26 per cent. The same variety grown at Ottawa has 26·6 per cent of hull. The original sample imported from France had 28 per cent of hull, showing that it has not increased in thickness of hull since its introduction in this country.

The Tartar King oat grown at Ottawa seems to be somewhat thicker in the hull and has 34·35 per cent in a sample weighing $37\frac{1}{2}$ pounds to the bushel while another sample grown at Indian Head weighing $46\frac{3}{4}$ pounds per bushel has 27·9 per cent practically 28 per cent of hull. Another sample of the same oat from Indian Head weighing 35 pounds per bushel had 32 per cent of hull. The original sample as received from the Garton Bros., of England, weighed $39\frac{1}{2}$ pounds per bushel and had 30·94 per cent of hull. From these figures it is evident that the Tartar King is thicker in the hull than most other oats we have been growing.

The 'Wide-awake' oat, which I have referred to as spoken so favourably of in Scotland, as grown at Indian Head, weighed $46\frac{1}{2}$ pounds per bushel and had 27·4 per cent of hull. The Waverley, another of the new oats introduced by the Garton Bros., of England, grown at Indian Head, weighed also $46\frac{1}{2}$ pounds per bushel and had 26·7 per cent of hull. Those grown at Ottawa, weighing 41 pounds per bushel, gave 26·3 per cent of hull. The Goldfinder, a yellow oat brought from the Garton Bros., of England, as imported, weighed 35 pounds per bushel and had 24·9 per cent of hull ; grown here in Ottawa in 1902, it had 28·6 per cent of hull, with a weight of 39 pounds per bushel, and at Indian Head, 28·1 per cent of hull, with oats weighing 42 pounds per bushel.

In some instances there seems a tendency to produce a thicker hull in this country; in others a thinner one. Investigations have not yet gone far enough along this line to permit of any decided opinion as to the influence of climate on this subject. One point which our examinations seem to prove is this : that the actual weight of hull in a given number of kernels of any one variety of oats is practically the same, whether the oat weighs 30 to 40 pounds per bushel, and the difference in weight is made up in the size of the kernel. This, after all, is not a matter of much surprise, when we look carefully into the subject. When an oat during its growth heads out, the husk is of full size, and the framework for holding the kernel is all there. The covering for the future oat is fully developed, the flower is produced in the cavity prepared for it, fertilization takes place, followed by the growth to maturity of the kernel. The plumper the kernel, the heavier is the oat.

ANALYSIS OF HULLS AND KERNELS.

What gives to this subject the greatest importance is the fact that the hull contains a very small proportion of nutritive matter. The quantity of albuminoids or flesh-forming constituents and of fat in oat hulls is not much more than half of what is found in oat straw. Oat hulls, according to Henry, contain 3·3 per cent of total albuminoids. Mr. Shutt, the Chemist of the Experimental Farms, finds this to be only 2·6 per cent in Canadian oats, while in oat straw the average of six analyses gives 4·1, and for the kernel of the oat, 14·51, showing the immense difference in feeding value between the husk or hull and the kernel, and pointing to the importance of the farmer growing the plumpest and most productive sorts. The proportion of fat in the hull is relatively less. While the kernels contain 6·24 per cent of fat and the oat straw 2·1 per cent, the proportion of fat, as given by Henry, is 1 per cent in the hull, and by Shutt, ·78 per cent (a trifle over $\frac{3}{4}$ of 1 per cent). I append the results of Mr. Shutt's analysis, which is of the Banner oat grown in Ottawa in 1902.

CROP OF 1902, C.E.F.

Proportion of kernels to hulls :

Kernels..	71·92
Hulls..	28·08
	<u>100·00</u>

—	Moisture.	Albumi- noids.	Fat.	Carbo- hydrates.	Fibre.	Ash.
Oats, (whole grain)	12·74	11·22	4·82	58·84	9·47	2·91
Kernels	12·03	14·51	6·24	63·15	1·93	2·14
Hulls	10·19	2·60	0·78	49·63	31·63	5·17

FRANK T. SHUTT,

Central Experimental Farm,
OTTAWA, May 14, 1903.

Chemist, Dom. Expl. Farms.

From these statements and figures it will be seen that heavy oats are worth a higher price than light oats, as in buying them the purchaser gets a larger amount of the highly nutritious kernels. The kernel contains nearly six times as much albuminoids as the hulls and eight times as much fat.

Among the new kinds of oats which have been obtained for test this year at the Central Experimental Farm there are two rather extraordinary sorts, obtained from Great Britain, where they have been grown by the Garton Bros. One is a black oat called the Excelsior, and the other, a white oat, known as Storm King. Both are unusual for the size of the oat and the weight of the kernel. The proportion, however, of hull to kernel in these new oats is larger than in most of the samples I have referred to. Excelsior weighs 44 pounds per bushel and has 32.3 per cent of hull. Storm King weighs 40½ pounds per bushel and has 33.9 per cent of hull. Hence, notwithstanding the large size of the kernels of these new varieties, if they do not give a heavier crop than the Banner they will prove less profitable for feeding purposes than that variety, because they contain a larger proportion of hull, which is of little value for feeding purposes.

By Mr. Stephens :

Q. Have you experimented to find whether early sowing has anything to do with the weight of the hull ?

A. We have found practically no difference in that, although a good many samples have been examined. It is scarcely to be expected that it should. When the head of the oat comes out of the sheath the hull is there of full size just as in the ripened grain, and though when ripe it dries up to a certain extent in curing the average weight and thickness of the hull is there. Where the oat has a very stiff straw, as in the Tartar King, the hull is a little thicker. Some weaker strawed varieties have thinner hulls. We have grown one known as Doncaster, which has the thinnest hull of any sort we have tried. I think it will be found that no matter what the variety of oat, if you take 100 grains of any kind the hull will weigh practically the same whether the oat is 20 pounds to the bushel or 45 pounds to the bushel. But where the oat is very light the proportion of hull will be correspondingly larger. Hence the importance of getting plump oats, with more kernel, which, as I have said, contains six times as much of albuminoids and eight times as much fat as the hulls.

By Mr. Wright :

Q. Can they use these black oats at the cereal factories for foods ?

A. No, the managers of the mills will not buy oats from the districts where black oats are known to be grown for fear of getting some of them mixed with the white varieties, which would produce black specks in the oatmeal. Black oats usually bring about two cents per bushel less than the white sorts. Some people, however, prefer them for feeding purposes.

Q. In our section farmers do not feed ordinary black oats because the hulls cause a soreness in the throats of the animals.

A. They find the hulls strong and coarse ?

Q. Yes.

A. We have not found any objection from that source, but it is very likely there is something in it, because some of these varieties are rather thick in the hull.

By Mr. Stephens :

Q. I think in some districts they have machinery to take them off ?

A. Yes, in the oatmeal mills they do it. Putting the oats through a barley scutcher takes off the tips with the sharp awns completely, and at the same time increases the weight per bushel about 2 pounds.

By Mr. Kaulbach :

Q. Why is the Banner oat in the North-west, at Indian Head, so much heavier than at Ottawa ? Is it due to the climate ?

A. What did you understand to be the difference ?

Q. It was 46½ pounds at Indian Head, and for that at Ottawa you gave the weight as very much less.

A. That figure was given for the Tartar King. The Banner grown at Indian Head weighed 44½ pounds, that grown at Ottawa 42½ pounds in field culture, but in some of the experimental plots there was some rust, which reduced the weight of the kernel in some instances to about 34 pounds, whereas in the field plots, where we had no rust, it reached the higher weight. A favourable season with no rust will always result in a heavy sample. I would again emphasize the fact that in buying oats it pays the farmer to give a higher price for a heavy oat. When he gets an oat that will weigh 40 pounds to the bushel, he gets a larger amount of this very rich and highly nutritious food of which the kernel is composed.

By Mr. Ross (Victoria) :

Q. Can you explain to us why the average yield at the Nappan Farm is so much higher than here ?

A. At the Nappan Farm and all through that part of Nova Scotia the oats this year were unusually heavy in crop. When I first received these returns, I thought there might possibly be some error in the figuring, but careful inquiry satisfied me that they were correct. The Superintendent also cited instances of neighbouring farms where the crops had been just about as good.

By Mr. Wilson :

Q. Was there much difference ?

A. There was a difference of nearly 25 bushels per acre between the results had at Ottawa and Nappan. The figures are given in Bulletin 41.

By Mr. Robinson (Elgin) :

Q. Have you included any hullless oats in your trial plots ?

A. We have tried a Chinese hullless oat, but we find it difficult to get them in commerce with a high degree of vitality. Sometimes only a small proportion of them will grow, and in productiveness they are not equal to such oats as the Banner.

By Mr. Kaulbach :

Q. In the reply given to my question in reference to oats, in regard to the greater quantity at Indian Head as compared with that at Ottawa, can you say whether it was from the rust that was prevalent here at Ottawa that the difference was so great ?

A. I think that was the reason, as the field crops, where there was no rust, the oats were heavy.

Q. You do not attribute it to the character of the soil or the temperature ?

A. Some part of it may be due to the soil, as that is very much richer at Indian Head than at Ottawa, and as a rule, and I think largely on this account, the land there gives a larger number of bushels per acre. I think the climate here is just about as favourable as it is at Indian Head, if we had an equally rich and fertile soil.

Q. I am sorry I was not here when the reference was made to the cultivation of clover. I followed up the information I received from the Experimental Farms here, and I adopted the idea of using some clover on a completely barren soil, a soil exhausted of its growing properties from being over-cropped. It was growing nothing when I purchased it but weeds and carraway and thistles. My experience was, that in following out the idea that I got from the farm here that sub-soiling turned out all the exhausted matter and buried the weeds, which disappeared completely in the following

year, and turned up a large proportion of red clay, upon which I sowed the clover and then turned it down after it had grown about six inches, and sowed timothy, clover and oats together. I cut that crop in autumn, and it was a good crop, and fed it and top-dressed from that crop, and I found an excellent crop the next year; and I have been in that way bringing the farm into a state of good cultivation without putting anything on but what comes from the soil itself and the clover crop. I found this to give excellent results.

A. I am sorry Mr. Kaulbach was not here to hear the evidence given in reference to the series of plots we have had under experiment with fertilizers for fifteen years. For ten successive years these plots were sown with oats, or wheat, or barley, with two check plots, among them where these same cereals were grown without any fertilizer. After that these fertilized and unfertilized plots were annually cropped with the same grain, using no fertilizer but clover, and this has increased the average crop in two or three years fully 50 per cent.

By Mr. Cochrane :

Q. Have you any trouble on your farm in getting a good catch of clover ?

A. We have not had any trouble.

Q. Do you sow on fall ploughing ?

A. We sow with the grain in the spring on fall ploughing. We prefer very much to have fall ploughing.

By Mr. Cargill :

Q. Do you find as good results from enriching the soil by using clover as from enriching it by using barnyard manure ?

A. I do not know that I can answer that question directly, as we have not used them side by side. Our object has been to try in these experiments to eliminate everything that could create error in the results, and we have not used barnyard manure in connection with the clover. But in the experiments on these plots carried on for ten years different fertilizers were used. One plot received twelve tons of rotted manure annually per acre, and the adjoining plot twelve tons of fresh manure. After good crops had been grown on these plots for ten years, all fertilizers were discontinued and the ploughing under of clover substituted. Under this treatment all the plots have given increased crops. Those, however, which had barnyard manure have not increased so much as those which had artificial fertilizers or no fertilizers.

By Mr. Cochrane :

Q. Can you give me an idea—we have no idea on the farm—just how much a ton of manure is ? How much would there be in a load ?

A. We usually carry on our big wagon boxes, on the experimental farm, about one and a half to two tons. Its weight depends on the condition it is in. If it is fairly compact and moist, you can get a good deal more weight on the wagon. A good, ordinary two-horse load would not be much more than a ton, or a ton and a quarter.

By Mr. Cargill :

Q. How many tons would be a good coating for an acre ?

A. We prefer to use about twelve tons and to use it every three or four years rather than to use eighteen to twenty tons every fifth year.

Q. Well, in using twelve tons to the acre every year and seeding down with clover each year, what would be the relative cost to a farmer, the difference in cost between the clover, using it as a fertilizer, and putting the twelve tons of manure on the acre ?

A. Clover seed has lately been higher than usual. The twelve pounds needed for an acre can usually be bought for about one dollar and twenty cents. This year it has cost about a dollar and eighty cents.

Q. Then that would be equivalent to the hauling of twelve tons of manure to the land.

A. I would not like to say that. The clover would give as much nitrogen to the soil as twelve tons of barn-yard manure, but not the same quantity of potash or phosphoric acid. I do not think clover can be made to take the place of barn-yard manure, but by its use barn-yard manure may be made much more effective.

Q. What I wanted to get was this ; that whether it be cheaper for the farmer to fertilize his land by sowing clover than to fertilize it by putting on twelve tons of manure counting the cost of labour and all the outlay.

A. I think there is no doubt that the results we have had in increased crops on many of these plots has been as great from one crop of clover as we have got at other times with ten tons of manure. At the same time I think that manure is of the greatest value to the land, and I would not like to say anything that would lessen its importance in the eyes of the farmer. What we advise farmers to do is to put on as much as they can of good barn-yard manure on their land. To put on if practicable twelve tons every three years and use clover in the interval. If they do that they will build up their land so that it will produce every year better crops than in the past.

Q. That is what we want to do ?

A. Yes, we are all aiming to produce as large crops as we can. And the fact that during the past year there was over seven bushels of oats produced in Ontario to the acre more than the average for the past twenty years is, I think, evidence of the value of the work which has been done for farmers and that better methods are beginning to prevail all over the country.

By Mr. Cochrane :

Q. You must remember that it was a moist year ?

A. I know it was a good season, and that counts much, but I think that improved methods of farming are entitled to some portion of the credit.

Q. I would like to ask the Professor if he restricts the number of these bulletins which he prints ?

A. My instructions in regard to the printing of bulletins are to get a sufficient quantity printed to supply the mailing list of the experimental farm and to leave a small surplus—our Canadian mailing list requires about 50,000 and the foreign mailing list three or four thousand, and we print 60,000 so that we can send to any member who desires them a few copies from 25 to 50 until the small stock left over is exhausted.

Q. I think it is a great pity that there was any restriction, because I think the information is a great deal more effective in this form than in the regular report, because they are too voluminous, but when the people get them in bulletin size they can grasp the information contained much more readily.

A. We send them to every one who asks for them.

Q. Yes, but do you not see that there are a great many people who do not know any thing about them until they get them ? Of course, if I had a certain number under my control, I could send them to the farmers in my riding who do not know anything about it now.

A. We have many farmers in all the ridings on our mailing list, and if the farm publications were distributed through the members as well, there would often be a duplication.

By Mr. Wilson :

Q. Every member sends in a mailing list, does he not ?

A. Yes, he can send in as many as he chooses, in reason, and they are entered on the permanent mailing list.

By Mr. Richardson :

Q. You stated a little while ago that you had not very good results through sowing clover as a fertilizer in Manitoba. Let me ask, on what kind of soils do you find the highest and the best results ?

A. In Manitoba and the North-west it is not so much a question of soil as it is a question of season. In a season that is reasonably favourable we do not find any difficulty in getting a good catch of clover at Brandon or Indian Head. What I said was, we have not had the same success there with clover sown with grain as we get in the east. In this part of the Dominion clover is sown with grain in the spring and ploughed under in the autumn. In this way the land is benefited without interfering with the regularity of the crops.

Q. What I mean is, what kind of soil, say down here, do you find most profitable and giving the best results from the use of clover as a fertilizer ?

A. On fairly good loamy and moderately heavy soil clover will make a stronger growth than it will on light sandy land, although it will do fairly well on light soil if it is in a reasonably good condition.

By Mr. Cochrane :

Q. Have you ever tried what clover will do when sowing it without grain at the Experimental Farm here ?

A. Yes, we have sown clover frequently in plots by itself, so as to test the value of the different varieties and the effect on their growth of the application of certain fertilizers.

Q. Then, it gives a good crop ?

A. It generally gives a better crop than when sown with grain, and generally grows heavy enough to require cutting once before the autumn. When it is desired to give the land the full benefit of the clover, if it cannot be pastured by animals, the cut clover is usually allowed to lie and decay on the ground.

PLOUGHING CLOVER UNDER.

Q. Last year, in our section of the country, the second crop was so large that on some farms we could not get it cut. In fact, they did not want it. What would the effect be of that crop, if ploughed this spring—the old crop and the roots ?

A. I think the results would be excellent and that the following crop would be much increased. In this way you would get the full benefit of the clover. We have found that even when the clover is killed out during the winter, that the dead parts have been very beneficial to the soil, although it has not done quite so much in increasing future crops as when the clover has been ploughed under green.

By Mr. Kaulbach :

Q. The better time for ploughing under would be in the autumn, would it not ?

A. That is the best practice, where you are sowing spring grain and do not want to miss a crop. Of course, if you are going to devote your land to potatoes or corn, we prefer to leave the ploughing under of the clover until about the middle of May following.

Q. Are clays more conducive to the growth of clover than any other soil ?

A. I think perhaps clover does grow more vigorously in a clay loam, but it grows well also in good sandy soil. That has been our experience here in Ottawa.

PREVENTIVES TO RUST IN OATS.

By Mr. Stewart :

Q. With regard to oats, do you find that by early sowing you avoid the rust ?

A. Yes, to a considerable extent the later oats are sown the more they are liable to rust, but rust has not often affected them with us so as to lighten the crop materially.

By Mr. Cochrane :

Q. Did you ever try salt to prevent it ?

A. We have tried salt for a series of years on oats, wheat and barley, and we have not found these plots to be exempt from rust, although we have used 300 pounds of salt per acre each year.

Q. Did you ever try plaster on clover to see what the effect is ?

A. Yes, we have tried plaster and found the results beneficial, and it is a very good fertilizer for clover.

MANURING LAND.

By Mr. Erb :

Q. When you spoke of 12 tons to the acre of manure, did that apply to the experimental plots or the field plots ?

A. It applied to the experimental plots. Our experimental plots are limited to three large fields. Two of these are required each year for the plots of cereals, and the other is used for field roots, Indian corn and potatoes. The manure, 12 tons to the acre, is applied for the latter crops, as they can all be hoed and the ground thus kept clean, and the land is left thus in good condition for the two grain crops which follow.

Q. I was out on the farm the other day and noticed a field west of the orchard which looked as if it was being got ready for corn ?

A. With many small heaps of manure on it ?

Q. Yes. I should judge that there must have been about 25 tons of manure to the acre.

A. That field is manured, as near as can be estimated with about 18 to 20 tons to the acre. That is part of the five years' rotation.

Q. That is being got ready for corn and roots ?

A. Yes. The manure is all fresh from the barnyard and looks more bulky than where it has been allowed to stand a while. We find it more economical to use the manure in a fresh condition.

PREVENTIVES TO SMUT IN WHEAT.

By Mr. Lang :

Q. Do you ever have smut in your wheat ?

A. Yes, to some extent. The variety of smut we have here is what is known as smut, and may usually be prevented by soaking the grain in a solution of formalin.

By the Chairman :

Q. You prefer formalin to bluestone ?

A. Yes, this form of smut is different from the bunt smut or stinking smut in wheat. For that sort of smut bluestone is the best remedy.

By Mr. Wright :

Q. I was at the farm one day when you were putting some oats in your silo ; how did it turn out ?

A. Very well. Mr. Grisdale, the agriculturist, who has charge of that branch of the work, will probably appear before the Committee later, and will then give you full particulars about it.

CROP ROTATION.

By Mr. Cochrane :

Q. You have a five year rotation ?

A. Yes.

Q. Can you tell the Committee what it is, beginning this year with corn ?

A. This year, a hoed crop, corn and field roots ; next year, grain, seeded with clover and timothy ; third year, clover, hay or pasture ; fourth year, hay or pasture ; fifth year, grain with ten pounds of clover seed per acre, clover to be turned under with the manure for the hoed crop the year following.

CLOVER AS A FERTILIZER.

By Mr. Cargill :

Q. I infer, from what you say, that 12 pounds of clover seed sown in the spring with the grain, and the crop turned under in the autumn, is equivalent to 10 tons of barn-yard manure ?

A. It is scarcely equivalent in every respect. In the amount of nitrogen added to the soil it is no doubt quite equal in its good effects to 10 tons of manure, and the quantity of humus it gives to the soil is probably greater. Humus is a very important constituent of soils, as it enables a soil to hold more water and furnishes other conditions favourable for plant growth. All plants take up their food in solution in water, and where a sufficient quantity is present in the soil, they build up their structures in favourable weather very fast. We are all familiar with the sponge. If you soak it in water and then hold it up, there will be a steady stream run from it, gradually diminishing until it will cease to drip, but even then there is a lot of water in the sponge, as you will find when you squeeze it. That is a simile which is often used to describe a soil well supplied with humus. It holds a considerable quantity of water stored throughout its substance, furnishing conditions very favourable to plant growth. A well-grown mat of clover from a spring seeding furnishes the soil, when it is ploughed under in the autumn, with a large quantity of nitrogen and much humus. The clover also takes up from the lower depths in the soil, which the shallower root systems of other plants do not reach, supplies of phosphoric acid and potash, so that the clover is practically an enricher of the soil in these elements also. The clover is a most useful addition to the soil, and where farmers cannot get as much manure as is needed, they can add much to the stock of plant food in their land by the ploughing under of clover.

Q. I have been telling my farmers—we have some rich farmers—rich farmers who have been feeding stock, making manure and growing large crops ; they have facilities for stabling stock, but our poor farmers have not—and I have been quoting you as an authority that it is beneficial to use clover to seed down with every crop of grain that is sown. I myself sow clover with every grain crop, and I advise farmers to do the same thing. And another reason for that is, of course, that in the early settlement, when the soil was in the virgin state, it would grow any sort of crop, and the people were healthy and prolific, and had large families, and could get labour cheaply. To-day everything is different : farm labour is scarce, and I want to know if seeding clover is as economical as a fertilizer as barnyard manure, for, if so, it would be well for all our farmers to adopt it ?

A. It is useful and economical, but it will not entirely take the place of barnyard manure. It is economical, because the farmer gets for the expenditure of about one dollar and a quarter an improvement in the quality and crop-producing power of his soil which would cost him ten times that sum to bring about in any other way.

By Mr. Kaulbach :

Q. We thus see that where a man is poor and has little manure, he substitutes clover to get his fields into condition ?

A. Yes, and he can thus feed stock and make more manure, and build up his farm by this practice.

SPELT WHEAT.

THE WITNESS.—Now, Mr. Chairman and Gentlemen, if we have finished with the clover subject, I would like to bring before you a few facts regarding Spelt wheat. This is a comparatively new grain to most of our farmers, but it has long been cultivated in Europe. The variety introduced into Canada of late years under the name of Spelt wheat is not a true Spelt, but is known in Europe as the common Emmer.

The Emmers are easily distinguished from the Spelt by the form and character of the head. The Common Emmer is the variety which has become generally known among the farmers of Canada as Spelt wheat. Besides this, there is grown in Europe the Ufa Emmer, which closely resembles the Common Emmer, White Emmer, Red Emmer, Double Emmer, and the Long Emmer.

Of the true Spelts we have Red Spelt, Black-bearded Spelt, White Spelt, White-bearded Spelt, and Smooth Spelt. All these varieties have been grown on the central experimental farm, and I have samples of the heads here for your inspection.

By Mr. Kaulbach :

Q. From what does Speltz derive its name ?

A. I could not answer that. It is commonly known as 'Spelt' in England, but here the German way of spelling the name has been commonly adopted, so that it has become known as 'Speltz'. It is mentioned in the Bible, in Genesis, as 'Spelt'. It is also said to have been grown by the ancient Egyptians. With reference to its hardiness and its ability to grow and produce a crop on poor ground, it somewhat resembles rye. Both the Spelt wheats and the Emmers are grown in Europe in mountainous districts, where the land is very poor, and they give returns where the ordinary varieties of wheat would scarcely give a crop worth harvesting.

By Mr. Bell :

Q. Is it grown in France ?

A. Yes, in France, Germany and Russia.

Q. Do you know if it bears the same name in all these countries ?

A. In Germany the variety we have grown here is called Emmer.

Q. Is it called Speltz in France ?

A. It may be, but I am not sure of this.

By Mr Wright :

Q. Is it good for feed ?

A. Yes, we have found it useful for that purpose. You will observe, from the examples submitted, that the true Spelts have a very long and open head and the spikelets project. The kernels are more rounded and fit into the stem much the same as our ordinary wheats do.

RELATIVE VALUE OF EMMER AND SPELT WHEATS.

The relative value of these different sorts of Emmer and Spelt depends largely on the proportion of husk they have. In ordinary threshing very little of the grain is liberated, most of it still remains in the hull.

Although we have no results of analyses at hand, it is altogether probable that the hulls, in common with those of the oat, have a low feeding value.

The proportion of hull to grain has been carefully determined at the Central Experimental Farm with the following results :—

Common Emmer.....	22.4	per cent.
Red Emmer.....	22.6	"
White Emmer.....	23.9	"
Long Emmer.....	25.5	"
Double Emmer.....	27.6	"
Ufa Emmer.....	29.2	"

The proportion of hull in the different sorts of true Spelt tested, was as follows :—

White-bearded Spelt.....	27.5	per cent.
Black-bearded Spelt.....	28.7	"
Red Spelt.....	29.6	"
Smooth Spelt.....	32.4	"
White Spelt.....	38.1	"

It will thus be seen that the different sorts referred to vary in proportion of hull to grain from 21.4 per cent to 38.1 per cent.

By the Chairman :

Q. Less than the oats ?

A. Yes, the Emmers give a less proportion than the oats. Some writers, when comparing the yields of Emmer or Speltz with other wheats, have taken the measured bushel of unhulled grain, which usually weighs from 32 to 34 pounds, and compared it with clean wheat weighing 60 pounds or more per bushel. Under such comparisons the Spelt wheat shows up well in bushels per acre, but such a method is manifestly unfair to the wheat. Others have taken the grain, weight for weight, that is, 60 pounds of the unhulled Speltz for the bushel, with 60 pounds of clean wheat. This, although a fairer method than that of taking the measured bushel as a standard of comparison, is still unfair to the clean wheat. The just method would be to deduct from the weight of the Speltz about 25 per cent for the weight of the hull and then make the comparison with the clean grain. The yield of Speltz, or more correctly Emmer, at the several Experimental Farms in 1902, taking the grain with the husks at 60 pounds to the bushel, has been as follows :—At the Central Farm, 30 bushels per acre ; at Nappan, 43 bushels 20 pounds ; at Brandon, 34 bushels 40 pounds ; at Indian Head, 40 bushels 20 pounds, and at Agassiz, 37 bushels, the average of the crop at all the farms being 37 bushels 4 pounds. If 25 per cent be deducted for the hull, we have an average of 27 bushels 48 pounds per acre, which in feeding value is probably equal to about 35 bushels of barley per acre.

I say probably, because we have no satisfactory analyses yet of the grain of the Emmer or Spelt, but I think there is not much doubt that these wheats have more albuminoids and are more rapid flesh-formers than barley.

By Mr. Sproule :

Q. What would be the per cent of feeding value, as compared with the same number of bushels of ordinary wheat ?

A. It is probable that it would be about the same. That, however, can only be determined by further experiment.

By Mr. Cargill :

Q. How does it compare in value with pease ?

A. That has not yet been definitely determined.

By Mr. Wilson :

Q. It is only fit for feeding cattle ?

A. It has been used in this country for feeding both steers and hogs.

Q. Not for flour ?

A. I do not know of any instance where it has been used for flour in this country.

By Mr. Richardson :

Q. Is this the grain from which the black bread is made ?

A. That, I think, is made chiefly from rye, although there may be more or less of this mixed with it. I am not familiar with the manufacture of that form of bread, but I know that in the North-west Territories I occasionally meet among the Hungarians and Russians with bread quite dark in colour which I have understood was partly rye and partly inferior flour. It is no doubt nutritious, because the people who feed on it are strong and vigorous, perhaps more healthy than those who feed on more choice forms of cereal products.

Q. It is the main bread used by the people in the north of Europe ?

A. The results of our experiments with Spelt and Emmer wheats have not indicated that they are of any great value to us in this country, where we can grow the finest class of wheat and the best varieties of barley. Barley can, I think, be grown in most localities to greater advantage for feeding stock, and in districts where peas are not very subject to the bug, these also can probably be grown with more profit than the Spelt. Some claims have been made in favour of Spelt on account of the straw, which is said to be more valuable for feed purposes, as the straw is slender in its growth. I think it would be eaten more readily by cattle. It is, however, more liable to lodge.

The CHAIRMAN.—If you will allow me, I would like to say a word about Spelt in the North-west. We had ten acres last year of very fine crop ; the yield was most satisfactory all round. A man in our district who has grown it for several years is very much in favour of it, and it has been found that in fattening steers and sheep that Spelt fed three times a day without hay did remarkably well.

Mr. WILSON—I suppose any grain would do well and produce good results, if fed three times a day ?

The CHAIRMAN—Three sheaves a day is not very heavy feed. Stock eat it very readily, and horses will eat it, too. Still it is growing in favour, and I must certainly say that in our district in the North-west it is becoming a favourite.

Mr. WILSON.—Would you prefer it to oats for feed in the sheaf ?

The CHAIRMAN.—I think I would prefer oats for horse feed.

By Mr. Robinson (Elgin) :

Q. You introduced a variety of spring wheat called "Preston" ?

A. Yes.

Q. With what result, last year ?

A. As I propose to take up the subject of wheat at the next meeting, and have, I fear, already occupied the full time, I will, with your consent, defer my remarks on the Preston wheat until then.

HOUSE OF COMMONS,

Room 34,

FRIDAY, June 12, 1903.

The Select Standing Committee on Agriculture and Colonization met here this day at 10.45 a.m., the Chairman, Mr. DOUGLAS, presiding.

Dr. W. Saunders, Director of Dominion Experimental Farms, again attended, at the request of the Committee, and submitted the following evidence :—

MR. CHAIRMAN AND GENTLEMEN,—I desire to lay before you this morning the results of the experiments which we have been making at the Central Experimental Farm, and at the branch farms, in connection with the raising of wheat, the production of new varieties, and the determination of the relative qualities of the different varieties. Although wheat is not relatively so important a crop, nor does it cover so large an acreage in Ontario as oats, it is in Manitoba and the North-west much more important, and when we consider the rapid settlement now going on, which will be followed by the breaking up and cultivation of large areas of fertile land in the Canadian North-west, and the unlimited possibilities for the production of this valuable cereal there, its relative importance among the agricultural products in this country must in the near future be very great. Hence, every encouragement should be given to the growing of the most productive varieties of wheat, of the highest quality, so that farming in the North-west may be made so remunerative as to attract settlers from all parts of the civilized world.

By Mr. Ross (Ontario) :

Q. As a matter of fact, is not Manitoba No. 1 hard the finest wheat in the world to-day ?

A. I think it is, and I hope I shall be able to bring before you presently some evidence in regard to that point.

THE WHEATS OF THE WORLD.

The wheats grown throughout the world consist mainly of five different species and their varieties. *Triticum vulgare*, in which are included most of the spring and winter wheats cultivated in America, Great Britain, and in many of the European countries, and in Australia, for the making of bread. *Triticum durum*, a class of wheats which are known as hard wheats, not in the sense in which we use that term in this country, but in the sense in which it is used in Europe. This includes some hard ricey wheats, represented in this country mainly by a variety known as Goose wheat, which is a valuable wheat for macaroni and pie-crust, and is used in some countries for bread. This class also includes Roumanian, Greek Summer and other sorts. There are very large quantities of these wheats grown in Southern Europe, and recently the United States Government has encouraged the growing of them in many parts of the Western States, and has imported large quantities of seed and distributed it, during the last two or three years, so as to ascertain where it can be grown to greatest advantage, so that sufficient quantities may be raised in America for the making of macaroni to supply the home consumption.

Q. Is the American designation of these wheats macaroni wheat ?

A. Yes. and they are being distributed as macaroni wheats.

By Mr. Henderson :

Q. Do we produce a surplus of that wheat which is used for macaroni ?

A. Yes, so I understand.

Q. Where is it sent ?

A. I am told it is sent to Europe. There is a growing demand for macaroni wheats in Italy and France, and although our millers and grain-buyers have discouraged the growing of these wheats in Ontario, our farmers have found that they are less liable to rust, are more vigorous in growth, and on the average will give a heavier crop than most others, and they have been content to take a lower price rather than give up their cultivation. In the earlier period of the cultivation of Goose wheat it was sometimes as much as 10 cents a bushel less than other wheats, but of late years it has brought nearly the same price.

By Mr. Ross (Ontario) :

Q. I think we should discourage the Goose wheat, because it is getting so mixed with our soft wheat, our Ontario wheat, that it is not so profitable to ship.

A. I did not know there was any trouble of that sort.

Q. We do not use it for flour in this country.

A. Another of the wheats grown in the world is that known as *Triticum Polonicum*, or Polish wheat, which in quality is much like the varieties of *Triticum durum*. It produces large kernels and large loose heads, and the grain is hard and ricey, like Goose wheat.

By Mr. Stephens :

Q. Are these all spring wheats ?

A. Yes. The Polish wheat is usually a light cropper. The fourth class of wheats are those known as Emmers (*Triticum Dicoccum*). These in some respects resemble our rye. They adapt themselves to the mountain regions and succeed where the soil is too poor to grow better sorts of wheat. There are also the Spelt wheats, *Triticum Spelta*, which are distinct from the Emmers. These five classes include all the varieties of wheat grown generally throughout the world.

The origin of the wheat plant is unknown. There does not appear to be any reliable records of any of the varieties having been found growing in a wild state, but some of them have been in cultivation since very early times. The earliest mention of wheat in the Bible is in Genesis, chap. 30, v. 15. The Spelt wheats were grown by the ancient Egyptians and are still much cultivated in some of the mountain districts in Europe. The importance of the wheat crop may be gathered from the quantity produced and consumed in the world. It is certainly the most important of all the world's crops and the most valuable to mankind of all cereals. The total crop for the entire world in 1902 is given as 3,124,422,000 bushels.

The crop of wheat in Canada during 1902 was very satisfactory. In Ontario, 748,592 acres were occupied by winter wheat, which gave an average return of 26 bushels 8 pounds per acre, as against 20 bushels 3 pounds, the average of the past twenty-one years. Spring wheat occupied 303,115 acres and gave an average return of 20 bushels to the acre. The average crop for the past twenty-one years has been 15 bushels 7 pounds.

By Mr. McCreary :

Q. Have you there the amount of bushels of spring and fall wheat produced in Ontario ?

A. I have only given the acreage and yield. This would figure out about 19½ million bushels of fall wheat, and a little over 6 million bushels of spring wheat. In Manitoba, the acreage in wheat was 2,039,940, giving an average of 26 bushels per acre, or over 53 million bushels. In the North-west Territories, there were 585,576

acres under this crop, with an average return of about 25 bushels per acre, producing nearly 14½ million bushels. The wheat crop in Quebec and the Maritime Provinces, although growing in volume, occupies as yet only a small proportion of the acreage under cultivation.

The harvest weather throughout Canada was generally favourable, and the crop was well saved, and a large proportion of it has been of a high grade of quality. The wheats of the Canadian North-west, on account of the large proportion of gluten they contain, are now in great demand among the millers in different parts of the world for mixing with inferior and more starchy grades, so as to bring the flour they make up in quality to the standard required.

RESULTS OBTAINED FROM TEST GROWING OF WHEATS.

At the experimental farms persistent efforts have been made for many years to find out those sorts of wheat which are most productive and most profitable in this country, in order that their growth may be encouraged. Seventy-one varieties of wheat were tested at all the Experimental Farms in 1902, in the uniform test-plot experiments, in order that we might discover which were the most profitable for growing in this country. At Ottawa the average yield of all these varieties has been 36 bushels 26 pounds per acre, and the average of the 12 most productive sorts, 42 bushels 33 pounds per acre. At Nappan, N.S., the best 12 sorts have given an average of 52 bushels per acre. At Brandon the average was 37 bushels 4 pounds, and at Indian Head, in the North-west Territories, the average was 45 bushels 58 pounds per acre. The average crop of the best 12 varieties at all the farms was 42 bushels 41 pounds per acre, while the average return given by the whole of the varieties which have been under trial, at all the farms, was 37 bushels 33 pounds per acre.

Of the varieties which have been under trial for eight years, the highest average has been given by the Preston, which stands at the head for yield, having given an average of 34 bushels 59 pounds per acre, taking into account the eight years' trial at all the Experimental Farms in the Dominion. Next comes Goose wheat, with an average of 34 bushels 14 pounds, followed by the Rio Grande with 33 bushels 59 pounds. The Huron gave an average of 33 bushels 37 pounds, and Wellman's Fife an average of 33 bushels 36 pounds. The White Fife has given an average of 33 bushels 23 pounds, and the Red Fife, 33 bushels 16 pounds. Although the Red Fife has given a very good average yield, it has not come quite to the top in these experiments. As a rule, it is remarkable for its productiveness, and for its high quality, and for its power of adapting itself to all sorts of conditions of soil or climate. This wheat originated about fifty years ago. In the *Canadian Agriculturist* for 1861 the following account of its origin was given :—

'About the year 1842 Mr. David Fife, of the township of Otonabee, Canada West, now Ontario, procured through a friend in Glasgow, Scotland, a quantity of wheat which had been obtained from a cargo direct from Dantzic. As it came to hand just before spring seed time, and not knowing whether it was a fall or spring variety, Mr. Fife concluded to sow a part of it that spring and wait for the result. It proved to be a fall wheat, as it never ripened except three ears, which grew apparently from a single grain. These were preserved and although sown the next year under very unfavourable circumstances, being quite late and in a shady place, it proved at harvest to be entirely free from rust when all wheat in the neighbourhood was badly rusted. The produce of this was carefully preserved and from it sprung the variety of wheat known over Canada and the Northern States by the different names of Fife, Scotch, and Glasgow.'

From this it would appear that the Red Fife wheat has been in cultivation for over half a century without showing any tendency to deterioration. It seems to be as good a cropper and as high in quality as it ever was. It was taken from Ontario to Manitoba and the North-west Territories, where it has evidently improved in quality, and as grown there it stands higher in the estimation of millers for the manufacture of flour than probably any other known variety.

EARLY RIPENING WHEAT.

By the Chairman :

Q. Why is it that they make a reduction on the price of White Fife over Red Fife of about 2 cents a bushel ?

A. The buyers may make that difference in price but there is not quite that difference in actual value.

Q. White Fife, of which I have had considerable experience, has given excellent crops and is not so liable to be injured.

By Mr. McCreary :

Q. If you ask the Minneapolis miller he will tell you the reason of the reduction in price.

A. I hope presently to bring before you the opinions of one of the best milling experts in Minneapolis on this subject. While the Red Fife is so excellent a wheat, it is, however, open to one objection, that it is rather late in ripening and during the past fifteen years we have had several seasons when early frosts have injured the grain so as to reduce its value very materially. Whenever this has occurred a great outcry has arisen from the North-west farmers, who have suffered, for an earlier ripening wheat.

In the endeavour to meet this demand varieties have been brought into Canada from many different countries which have been grown alongside of Red Fife, and their periods of ripening carefully watched and recorded. Some wheats have been brought from the colder districts in Northern Russia and other northern parts of Europe, some from high altitudes in India, as high as 11,000 feet in the Himalayas ; others from Australia and Japan. Both the Russian and Indian wheats have usually ripened in a shorter time than the Red Fife, but some have been inferior in quality and others have given such small crops that the growing of most of them has been abandoned.

During the progress of these experiments many cross-bred wheats have been originated, in which the effort has been made to combine the good qualities of two or more varieties, and in most of these Red Fife has entered into the combination. One of the earlier introductions from Russia, known as the Ladoga, which was on an average about a week earlier in ripening than the Red Fife, was crossed with that variety and a number of new sorts produced. One of these, known as Preston, a sample of which is herewith submitted, has exceeded the Red Fife in yield during a test of eight years by an average of 1 bushel 43 pounds per acre. That is taking the average on the five experimental farms for a period of eight years. It has also ripened on an average during the whole of that period, taking the results obtained at all the experimental farms, nearly four days earlier.

Another variety known as Early Riga was obtained by crossing one of the Indian varieties obtained from a high elevation in the Himalayas with a Russian wheat known as Onega, brought from near Archangel, one of the most northerly wheat growing districts in Russia. These were both early varieties but were not very productive. By crossing these, the variety known as Early Riga has been produced, which has ripened the earliest of any wheat we have yet tested. It has given an average return for the past four years at all the experimental farms of 30 bushels 45 pounds per acre, a yield $2\frac{1}{2}$ bushels less than that of Red Fife, but in earliness it exceeds the Red Fife by $8\frac{1}{2}$ days, which is a very important matter. These gains in earliness are of very great importance to the country, especially in view of the immense territory we have to the north of the present Canadian wheat fields where in the near future much wheat is likely to be grown. In the Preston we have a gain of $3\frac{3}{4}$ days with an average increase in the crop in eight years test of 1 bushel 43 pounds over Red Fife, and in Early Riga, an average gain for four years of $8\frac{3}{4}$ days in earliness with an average reduction of $2\frac{1}{2}$ bushels per acre in crop.

The next point of importance to discuss is the relative quality of these wheats from a milling standpoint, and also from the standpoint of the British market. In

determining quality it has been customary to take the Red Fife as the standard of excellence. The methods adopted for determining the quality of wheats by the large mills in Minneapolis are probably the best which have ever been devised. With their enormous daily output the interests at stake are very large, and every effort is made to maintain a uniform character and quality in the flour they place on the market. An expert with several assistants is constantly employed in ascertaining the quality of the different lots of wheat purchased. Small mills have been constructed in which the samples of grain can be reduced to flour in a very short time. The proportion of gluten they contain is accurately determined, also the density, colour and quality of the gluten, all of which bears on the character and quality of the flour. Another portion of the flour is made into bread, fermented, and baked in an electric oven at a temperature of 300 degrees F. In this way uniformity in the character of the tests is arrived at, so that an accurate and careful estimate can be made of the relative quality of all wheat purchased for milling.

AN AMERICAN EXPERT MILLING TEST OF CANADIAN WHEATS.

Through the kindness of Mr. L. P. Hubbard, of the Pillsbury-Washburn Flour Mills Company, Limited, I have been granted the privilege of sending samples of our Canadian wheats to be tested by their expert, Mr. J. H. Julicher. The samples sent have all been forwarded under numbers, and no information has been given as to the varieties submitted, or where they were grown. In this case eight samples were sent in the first lot, two each of Red Fife, Preston, Stanley and Percy ; one of each of these samples was grown at Indian Head, and the other at the Central Experimental Farm at Ottawa. In submitting Mr. Julicher's report, I have placed the names of the wheats after the numbers under which the samples were forwarded, so that the readers of the report may know to which they refer.

Wheat Inspection for Wm. Saunders, Experimental Farm, Ottawa.

	DOUGH.		GLUTEN.		Quantity.	Quality.
	Quality.	Action in Washing.	Density.	Colour.		
No. 7. (Red Fife, Ottawa)	White....	Excellent.	Excellent.	White....	p.c. 11·8	101
" 3. (Red Fife, Indian Head)	White....	Excellent.	Excellent.	White....	11·9	101
" 6. (Preston, Ottawa)	Creamy...	Good . . .	Good.....	Creamy White.	11·9	100
" 2. (Preston, Indian Head).	Yellow...	Good. . .	Good.....	Creamy...	11·9	100
" 8. (Stanley, Ottawa).....	Creamy...	Good.....	Good.....	Creamy White.	12·9	100
" 4. (Stanley, Indian Head).....	Yellow...	Good.....	Good.....	Creamy...	12·4	100
" 5. (Percy, Ottawa)	Yellow...	Good.....	Fair.....	Creamy...	13·3	100
" 1. (Percy, Indian Head).....	Yellow...	Good.....	Good.....	Creamy...	12·4	100

The samples marked 1 (Percy), 2 (Preston, I. H.), and 4 (Stanley, I. H.) are good wheats, but the others are better. I would favour 3 (Red Fife, I. H.) and 7 (Red Fife, Ottawa). In my opinion 3, 7 and 8 (the two Red Fifes and Stanley, Ottawa) would be excellent for milling, and bread made from flour of these would be very hard to match for quality, colour and strength.

March 24, 1903.

J. J. JULICHER.

These were all classed, as to condition, as very dry.

By reference to the table, it will be seen that the Red Fife from Indian Head was sent as No. 3, and the dough of this sample was white and excellent. The gluten also was excellent in density, white in colour; the proportion was 11.9 per cent, and the quality was 101. One hundred is regarded as good, but this is put at 101.

The Red Fife grown at Ottawa is graded exactly in the same terms, which was a matter of surprise to me, as I had understood that the Red Fife grown in the East was not equal in quality to that which is grown in the West. I am told, however, that the past season was somewhat exceptional in that respect, and that the difference in quality between Red Fife grown in the West and that grown in the East has been less this year than usual, the conditions having been such as to give to eastern samples a relatively higher quality.

By Mr. McCreary :

Q. Where was the seed brought from that was used at the Ontario farm ?

A. We have grown it here for eight years, but the original seed, I think, came from the North-west.

Q. It was the same seed : you did not get fresh seed the year before you sent this sample ?

A. No. There has been no change of seed for the past eight years.

By the Chairman :

Q. May I ask in what year this grain was sown ?

A. These were all of the crop of 1902.

Q. In 1901 the grain in the North-west was soft, I think, and I thought perhaps this might account for it ?

A. These were not from the crop of 1901, but were grown in 1902.

While the dough of the flour of the Red Fife was pronounced white, and the gluten white and excellent, that from the Preston from Ottawa was rated as creamy and good, with good creamy white gluten. The dough from the Preston from Indian Head is said to be yellow and good, and the gluten as good and creamy, indicating a slightly better quality in the Ottawa-grown sample.

Mr. Julicher says that the samples marked '1', Percy, and '2', Preston, Indian Head, and '4', Stanley, are good wheats, but others are better. He states that he would favour '3', that is Red Fife, Indian Head, and '7', Red Fife, Ottawa, and he says, 'In my opinion "3", "7" and "8"—which are the two Fifes and the Stanley at Ottawa—would be excellent for milling and bread made from the flour of these would be very hard to match for colour, quality and strength.' The Stanley, to which he refers here, and which he puts with the Red Fifes, is a twin wheat with the Preston. It is graded by Mr. Julicher as a trifle better than Preston, although he pronounces them all to be good wheats, and the reports I have recently had from an English expert, which I will refer to presently on the value in the British market of these several varieties, would go to show that the differences in quality in these several sorts is very slight.

In our efforts in wheat-breeding we are trying to get, for the use of settlers in the North-west, a wheat that will ripen a few days earlier than the bulk of their crop now. If a settler has 200 acres of wheat and has only limited help he has to begin cutting part of the crop when it is on the green side, or his wheat will shell badly before he reaches the end of his harvesting. The part of the crop which is cut first will shrivel more or less, which involves a loss in weight and sometimes in quality, to which must be added such loss as may arise from shelling. If by having fifty to seventy-five acres of an earlier sort these difficulties can be overcome it will be a very great advantage to the farmers of this country and will result in a large saving in the quality and character of the wheat grown.

AN ENGLISH EXPERT REPORT ON MILLING TESTS OF CANADIAN WHEATS.

A similar lot of samples, taken from the same bags, was sent to Lord Strathcona, High Commissioner for Canada, with the request that he would place them in the hands of one of the best English wheat experts for examination. A report on these has only just come to hand. Lord Strathcona says in his letter, which is dated May 27. 'With reference to your letter of the 12th of March, I now forward you the report of Mr. William Halliwell on the eight samples of wheat which you sent me. Mr. Halliwell is the technical editor of *The Miller*. He is lecturer on flour milling to the London County Council, registered teacher of milling technology at the City and Guilds Institute, and may therefore, I think, be regarded as a competent authority. He has, moreover, had twenty-five years' experience of practical flour milling and wheat buying.

I also inclose for your information a copy of the letter Mr. Halliwell wrote when sending me his report.

Mr. Halliwell writes as follows :—

ROOKWOOD, ROMFORD, May 22, 1903.

W. L. GRIFFITH, Esq.,

DEAR SIR,—I beg to forward you the result of my examination of the eight samples of Canadian wheat you were good enough to send me some days ago.

I have given them special attention from a practical miller's point of view, and I hope you will find the results to be of benefit to Canadian wheat-growers generally. There is an unlimited market for the best sorts of wheat in this country and when my report is published I hope proper emphasis will be laid upon this point. Pure high-class samples will be preferred to those from any other source, as these wheats from the Canadian North-west are constantly growing in favour with the millers of this country.

Yours faithfully,

(Sgd.) WILLIAM HALLIWELL.'

In writing to Lord Strathcona, I told him that it was intended to publish the opinion of the expert for the information of the people of this country, and Mr. Halliwell was asked to prepare his report with this in view. As his report is somewhat technical I will not encroach on the limited time at my disposal by reading it through, but with your consent will have it incorporated in the evidence. I desire, however, to refer to a few points mentioned by Mr. Halliwell in his report.

I may say, first of all, that in the letter written to Lord Strathcona an item of information was given which perhaps in justice to Mr. Halliwell would have been better withheld. I told him that samples 1 to 4 were from the North-west Territories, and samples 5 to 8 were the same wheats grown in Eastern Canada. Mr. Halliwell placed the North-west wheats throughout on a higher plane than he does the eastern wheats, whereas Mr. Julicher, who has a high reputation for his ability, and knowledge of the milling qualities of wheats, practically places the Ottawa Red Fife on a par with that grown in the North-west, not knowing anything at all about where either of them came from.

Mr. Halliwell says that samples Nos. 1 to 4, inclusive, that is Red Fife, Preston, Stanley and Percy, grown at Indian Head, are almost equal, 'There being a just perceptible difference, but not enough, I should say, to make a difference in the general selling price on our English markets.' The four samples of the same wheats grown at Ottawa he ranks somewhat lower in value but says that their general excellence is much better than one would expect from their outside appearance alone. In no case, however, would the latter numbers be sold at the price of those numbered 1 to 4. He puts these Ottawa grown samples in the following order of merit:—

'6' Preston, '5' Percy, '8' Stanley, '7' Red Fife.

Further on in his report he seems to reach a different conclusion and alters the relative position of these numbers, when he comes to speak of the price they would bring that day on the London market. He says : 'I have also compared the eight samples with others on the London Corn Exchange, May 21. I have been at the trouble to work them side by side in the examination, and I find that for strength (the ruling characteristic) Nos. '1', Percy, '3', Red Fife, and '4', Stanley, would sell at Mark Lane at 34s. 3d. per 496 pounds; No. '2', at 34s. ; Nos. '5', Percy, and '7', Red Fife, at 33s. 9d., and No. '6', Preston, and '8', Stanley, at 33s. 6d.

The results of these tests and criticisms show that the two cross-bred wheats, Percy and Stanley from Indian Head are, in the opinion of Mr. Halliwell, in every respect equal to Red Fife, taking into account colour, strength, appearance and milling structure. The Preston stands equal to Red Fife in appearance and milling structure, but falls slightly below in point of strength. In the first part of his report Mr. Halliwell speaks of this as a 'just perceptible difference, not enough, I should say, to make a difference in the general selling price on our English markets. But when dealing with the actual values of the samples on the London Corn Exchange, Percy, Stanley and Red Fife are given as being worth 34s. 3d. for 496 pounds, and Preston as worth 34s., which is equivalent to a difference in value of $\frac{3}{4}$ of one cent per bushel.

Again, in his valuation of the samples grown at Ottawa, he puts the Percy and Red Fife first, instead of putting the Preston first, as in the early part of his report, placing these at $1\frac{1}{2}$ cents a bushel less in value, and Preston and Stanley at $2\frac{1}{4}$ cents less per bushel in value than the same wheats grown in the North-west. These estimates of the relative value of these wheats in the London market, coming from so high an authority and a man of so much experience, are no doubt strictly accurate. The differences in actual value are less than one would suppose, judging from the relative prices of eastern and western wheats in this country. I have here for the inspection of the members of the Committee samples of these several wheats. The samples for the Minneapolis expert and for the English expert, also for the Chemist of the Experimental Farms and for the Committee were all taken from the same bags.

By Mr. Stephens :

Q. Is this sample (Preston grown at Central Experimental Farm, 1902) considered to be pure Preston ?

A. Yes.

Q. There is quite a difference in the colour of the grain ?

A. I may say that in many cross-bred wheats we find differences in the colour of the kernel, especially where the kernels of the parents are of different colours. Efforts are now being made to overcome this by separating the two colours before sowing, so as to obtain uniformity in the sample.

Mr. Halliwell's report is as follows :—

Critical examination of eight samples of Canadian wheat :

For strength, as viewed from the outside, from cutting the grains, and from reducing them to powder, I find they come out as follows : The samples are numbered 1 to 8. Four of them (1 to 4) are from Indian Head Farm and are called regular samples of No. 1 wheat. The other four (5 to 8) are from the Government Experimental farm at Ottawa. One to four are almost equal and may be classed as their numbers indicate, there being a just perceptible difference—but not enough I should say, to make a difference in the general selling price on our English markets. Following these I put the experimental samples (from Ottawa) in the following order, namely : 6, 5, 8, 7, and I might add that their general excellence is much better than one would expect to find from their outside appearance alone. In no case, however, would the latter numbers be sold for the price of those numbered 1 to 4. In making this statement, I am bearing in mind that the chief ingredient required in Canadian wheat is gluten or strength. Given that the nature of the wheat also guarantees a maximum of the other attributes which millers expect to find and do find in well

developed Canadian grown grain. Speaking as a miller I also am of opinion that the Indian Head samples (1 to 4) will yield more middlings, of larger and more even size, and of better shape and all round quality than those grown on the experimental farm at Ottawa. There would also be less break flour—a thing all millers try to avoid making, seeing that this quality of breaking flour is only akin to the lowest grade. I may explain this more clearly by saying that the object of all millers is to make middlings first and flour afterwards. Middlings can be purified and so prepared for conversion into the highest grades of patent flour, whereas if the structure of the wheat does not lend itself quite so readily to this performance, but is apt to be too easily disintegrated on the break rolls, the result means flour, and that of a much lower quality, seeing that it cannot be sent to the purifiers at all, therefore I say that according to my judgment, the break flour would be less in the first four samples. Going a step farther, I am of the opinion that the middlings made from the Indian Head samples would grade better—would be more even in size, in texture and in gravity. These are the three primary considerations which govern the successful milling operations, and they are ever present when buying high class wheat for milling purposes. Wheat particles—middlings—which grade well, are always found in the largest quantity at the head of the mill, where the highest priced patent flour is made. The wheats from the experimental farm at Ottawa do not, in my opinion, possess all these qualifications in the highest degree. They are not quite so compact in their structure, or in other words, they are of a slightly more mellow nature and are rather more inclined to break up more quickly, and also into more sizes, smaller sizes in fact, and thus there would be a tendency towards them being conveyed lower down the milling system before being converted into flour. This, of course, means that the larger percentage would be graded as second patents. To my mind, it appears as if the Indian Head wheats were grown under the better natural conditions and in quite different soil.

In the simple matter of flour yield, however, the Ottawa wheats are undoubtedly first, but, as I may be permitted to remark, mere flour yield is not the sole consideration regarding the buying of Canadian wheats. What we require first of all is strength, and given this, yield and colour follow as a natural consequence. When examining the various samples as intended for the purifiers, I still pin my faith to the Indian Head samples. They—as broken up by the millers break rolls—are more free from bran snips, more free from adhering bits of the branny coating, and are thus more easily operated upon, giving to the purifiers a slightly larger constant capacity, and, as I have already pointed out, this capacity is needed on account of the larger quantity of middlings made, yet at the same time, it is the highest recommendation because this larger quantity is to be made into patent or high class flour. Having been through the purifiers, the more compact middlings (Indian Head samples again) go straight to the reduction rolls, and are immediately reduced to flour, whereas whenever there is the slightest mellowness—or weakness I may call it—the flour does not get to the sack quite so quickly. Strictly, however, it is a question of strength, pure and simple, and I have endeavoured to point out my conclusions on that head particularly. Whichever wheat is strongest will get to the flour sack quickest. Patent flour is made where the strength is supposed to be, and when buying strong wheat, millers look to the points I have enumerated.

I have also compared the eight samples with others on the London Corn Exchange at the present time (May 21st). I have been at the trouble to work them side by side in the examination just given, and I find that for strength (the ruling characteristic) Nos. 1, 3 and 4 would sell off Mark Lane stands at 34s. 3d. per 496 lbs; No. 2, 34s; Nos. 5 and 7 at 33s. 9d., and Nos. 6 and 8 at 33s. 6d. A comparison with Canadian shippers' figures may be interesting. This will be best made by those more intimately interested.

In order to put my meaning in concise form I append a small table of the various constituents compared with what I find already on the English Exchange.

COLOUR MARKS.

Numbers								English Sample.	Maximum Price.	Maximum Marks.
1	2	3	4	5	6	7	8			
10	9	10	10	9	10	9	10	9	s. d. 34 3	10

STRENGTH.

10	9	10	10	9	8	8	8	9	10
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APPEARANCE.

10	10	10	10	8	8	8	8	8	10
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MILLING STRUCTURE.

10	10	10	10	9	9	8	9	9	10
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In conclusion, I should just like to add that not nearly enough of the first quality reaches our principal markets. This may of course arise from the fact that most of it is milled in Canada. Our regular samples do not on the whole reach up to the maximum, but may be said to be a shade better than what I found when I mixed several together. It would also be to the general advantage if the grades were kept more distinct and a stricter line drawn between the best No. 1 sorts and No. 1 ordinary. The best is always welcome, will always fetch the highest price, while mixing of any kind whatsoever spoils them for one or other of the points I have just enumerated.

(Sgd.) WILLIAM HALLIWELL.

Q. You regard the difference in colour as due to the nature of the soil ?

A. Not entirely. These differences are not easily explained. Eastern grown specimens are generally more starchy and softer than those grown in the North-west.

By Mr. Maclaren (Huntingdon) :

Q. Why did you not withhold all information as to the origin of these samples as you did with those you sent to the Minneapolis expert ?

A. It did not occur to me at the time, that there could be any objection to giving this information, but I now think it would have been better to have sent the samples without giving any information as to their origin.

By Mr. Robinson (Elgin) :

Q. How much did you send ?

A. Three pounds in each case.

A second lot of samples was sent to Mr. Julicher, of Minneapolis, numbering six in all, two of White Fife, one of which was from Ottawa and one from Indian Head ; one of Early Riga grown at Indian Head, this being the very early ripening wheat to which I have already referred, a cross of Onega with Gehun, another was a

sample of Laurel from Ottawa, a cross between Red Fife and Gehun, and two samples of Goose wheat, one from Ottawa and one from Indian Head. The Laurel was sent because it had given an average yield of 33 lbs. per acre in excess of Preston on a 4 years test and 2 bushels 16 lbs. per acre more than Red Fife. Mr. Julicher's report on this second lot of samples reveals an interesting fact in regard to the variety known as Early Riga. He says that a careful analysis has been made of the samples and number 9, that is the White Fife, from Ottawa, and No. 14, which was the Early Riga grown at Indian Head, are varieties of excellent quality. No. 11, Laurel of Ottawa, and No. 12, White Fife from Indian Head, are of good quality. It will be seen that he puts the White Fife from Ottawa higher than the White Fife from Indian Head. He says that number 10, which is Goose wheat grown at Ottawa, is a very poor quality for milling and bread making, and he has the same to say of No. 13, which was Goose wheat grown at Indian Head. Of these two Goose wheats, he would favour No. 13, which was the sample from Indian Head. His report is as follows :—

MINNEAPOLIS, Minn., April 6, 1903.

	DOUGH.		GLUTEN.			
	Quality.	Action in Washing.	Density.	Colour.	Quantity.	Quality.
					p. c.	
No. 9 White Fife (Ottawa).....	Creamy-white.	Excellent.	Excellent.	White....	11·8	101
No. 12 White Fife (Indian Head)....	Creamy...	Good.....	Good.....	Creamy...	11·1	100
No. 14 Early Riga (Ottawa).....	Creamy-white.	Excellent.	Excellent.	White....	14·2	101
No. 11 Laurel (Ottawa).....	Creamy-white.	Good.....	Good.....	White....	11·1	100
No. 10 Goose (Ottawa).....	Dark....	Poor.	Ductile...	Dark.	11·4	90
No. 13 Goose (Indian Head).....	Dark-yellow.	Poor.....	Ductile...	Yellow. ..	12·8	95

The samples marked 9 (White Fife, Ottawa) and 14, Early Riga are of excellent quality; Nos. 11 (Laurel, Ottawa) and 12 (White Fife, Indian Head) are of good quality; but Nos. 10 (Goose) from Ottawa and 13 (Goose from Indian Head) are of very poor quality for milling and bread making, of these two I would favour No. 13 (the Indian Head sample).

In this examination Mr. Julicher puts the Early Riga in point of quality, higher than either of the samples of Red Fife, except that he makes the dough creamy white instead of white. He says it is excellent in the dough, excellent in the density of the gluten, white in colour of gluten, 101 in quality of gluten, and 14·2 per cent in quantity. This gives it about 20 per cent more gluten than the sample of Red Fife from Indian Head. So here we have a wheat which is eight and a half days earlier and higher in quality than Red Fife. It is possible that the season of 1902 may have been specially favourable to the Early Riga, but it is scarcely possible that any difference in season favourable to the production of a high proportion of gluten in the Early Riga would at the same time be unfavourable to the gluten content of Red Fife. This result as to the quality in Early Riga is most encouraging and a gain of eight and a half days in ripening is of the greatest importance, as it may permit of the extension of the area for successful wheat growing a considerable distance northward.

By Mr. Larivière :

Q. Do you establish this 8½ days difference on one year's growing ?

A. No. This is the average of four years' test. With the other wheats named it was the average of eight years' trial. The Early Riga has only been grown in these comparative tests on all the experimental farms for four years. In that time it shows a difference in earliness of ripening over Red Fife of about 8½ days, whereas 3½ days has been the average gain in earliness of the Preston at all the farms for eight years, when grown alongside of Red Fife. What these advantages may mean in the future wheat growing of this country it is impossible to say, but I regard these as great successes in connection with the important work of producing new varieties of cereals by cross fertilizing.

By the Chairman :

Q. I suppose it will be well that this expert evidence should be put into the report !

A. I think it is very important that the fullest particulars should be given to the public on this subject, and shall be glad to see that the wishes of the committee are carried out in this respect.

By Mr. Larivière :

Q. Where did you get this Early Riga variety ?

A. It was produced at the Central Farm in Ottawa, by crossing the Gehun wheat, which was obtained from a high altitude in the Himalayas, 11,000 feet about the highest point where wheat is grown, with a wheat from the Onega River, in the interior of Russia, near Archangel, very close to the Arctic Circle. These wheats were discarded from our trial plots, because they were low in productive power, but this cross seems to be a great improvement on the parents.

By Mr. Erb :

Q. Suppose you take those samples you have there and mix them, have you any one in your department able to separate them and classify them ?

A. With much care the kernels of some of the varieties might be separated into groups, but in other cases the kernels are too much alike to permit of this being done.

Q. So the ordinary buyer would not be influenced, because it was better ?

*A. I do not quite understand what you mean.

Q. I understand you to say that some expert in England said some wheat he examined was worth more than some others on the Mark Lane Exchange. Would he be able to judge by seeing the wheat ?

A. A man of good judgment and great experience in that way would be able, by seeing and examining the kernels, to separate the varieties which were in any way distinct, and pronounce on their value, much as the experts known as tea tasters, can often name the brand and pronounce on the value of a particular tea, or wine tasters can judge of samples of wine. This man with 25 years' experience in buying and milling wheat in London, is no doubt a first class expert in that line.

By Mr. Larivière :

Q. I suppose a miller would have more experience than a buyer ?

A. This man is both a miller and a buyer, and is the technical editor of 'The Miller,' in London.

By Mr. Maclaren (Huntingdon) :

Q. Mr. Erb thinks this difference in the price you speak of is on the bushel.

A. Not so, it is three pence per quarter, 496 pounds. That is about two-thirds of a cent per bushel of 60 lbs.

S—3½

By Mr. Erb :

Q. Would the ordinary buyer be able to detect this difference ?

A. It is scarcely likely that he would, but where a man has followed this as a business all his life, he attains an aptitude in detecting slight differences which many would not notice.

By Mr. Robinson (Elgin) :

Q. I notice up west with us there is a good deal of mixing of varieties in sowing wheat.

A. That is done, I understand, with winter wheats with the idea of producing larger crops.

ANALYSES OF WHEATS BY THE CHEMIST OF THE CENTRAL EXPERIMENTAL FARM.

Careful analyses have been made of the first eight wheats referred to, also of the Early Riga, by Mr. F. T. Shutt, Chemist of the Dominion Experimental Farms, and the results reached by him closely corroborate those obtained by the Minneapolis wheat expert, Mr. Julicher. Mr. Shutt reports as follows :—

CENTRAL EXPERIMENTAL FARM,
OTTAWA, May 2, 1903.

Report on Wheats—Percy, Preston, Red Fife, and Stanley—Grown on the Experimental Farm, Indian Head, N.W.T., and the Central Experimental Farm, Ottawa, 1902.

These wheats have been submitted to a careful chemical analysis, which included a determination of all the important constituents. The results are given in the accompanying table, which also presents certain data of a physical character, usually taken into consideration in determining the relative values of wheats.

In certain important features, well marked differences are to be observed between the wheats grown at Indian Head and Ottawa. These may be briefly alluded to as follows :—

Moisture : Invariably, the Indian Head wheats have the smaller water-content. Their average is 11·37 per cent, while that of the Ottawa grown samples is 12·40 per cent.

Albuminoids : As the analyses stand, two varieties—Percy and Preston—as grown at Ottawa, show a somewhat higher proportion of albuminoids than the same wheats grown at Indian Head ; in the case of the other two, Red Fife and Stanley—the percentages of this constituent, as obtained from the Ottawa grown samples, do not materially differ from those of Indian Head. The average obtained from the four varieties at Indian Head is 12·24 per cent, and of the same wheats, grown at Ottawa, is 12·64 per cent.

It has already been remarked that the Ottawa grown wheats contain the larger percentage of moisture ; it is, therefore, evident that calculated to a water-free basis, they would all show a higher percentage of albuminoids than those from Indian Head.

Gluten—Wet and Dry : Though intimately allied to the albuminoids present, these results being obtained by mechanical means, do not furnish as accurate a guide to the nutritive values of the wheats as those obtained by chemical analysis. It is of interest and importance, however, to note that they follow closely the albuminoid content, and thus furnish corroborative data as to the greater value, both from the milling and nutritive standpoint, of the Ottawa grown wheats. The analyses are as follows :—

Ottawa Samples : Wet gluten, 36·45 per cent ; dry gluten, 14·67 per cent.

Indian Head Samples : Wet gluten, 35·48 per cent ; dry gluten, 13·68 per cent.

The foregoing results as to albuminoids and gluten are not such as we should have predicted. Our own investigations in the past have almost invariably indicated that wheats grown in the North-west are richer in this respect than the same varieties grown in Ontario or the eastern provinces, and our results in this matter have received corroboration from those of Professor Richardson, late of the Division of Chemistry, Department of Agriculture, Washington, D.C., U.S., who some years ago made a very thorough investigation into the character of wheats as grown in the several States of the Union, and who was successful in showing that environment—soil, climate, and cultivation—had a great effect upon the composition of wheats. Wheat, of all the cereals, is the most susceptible to the influences of environment, and consequently we may well suppose as a result of an unfavourable season a wheat decidedly inferior to that usually obtained in the locality. These considerations lead the writer to conclude that the present data are somewhat abnormal, and are not to be interpreted as indicating that the environment as at Ottawa is invariably more favourable to a high protein-content than that of the North-west. The probability is that the seasonal or climatic influences last autumn at Indian Head, and probably other parts of the North-west, were not so favourable to the maturation of the grain as usual*

Oil or Fat : The data showing the percentage of this constituent do not call for any special or detailed comment. The average for the Indian Head samples is 2.35 per cent ; that for the Ottawa samples, 2.37 per cent.

Crude Fibre : This constituent practically represents the bran elements. The Ottawa grown wheats show a somewhat higher proportion, but the difference is slight. The averages are : Indian Head, 1.84 per cent ; Ottawa, 2.01 per cent.

Ash : As regards mineral matter, the Ottawa grown wheats show slightly higher percentages than those from Indian Head. The average for the former is 1.83 per cent ; for the latter, 1.49 per cent. This may be an additional indication of the more complete ripeness of the Ottawa grown samples.

In making a comparison between the varieties, judging of excellence chiefly from the albuminoids and gluten content, it is first to be noted that all the wheats are of the same general character, in many particulars almost identical, and would be designated as of first class quality. The amount and character of the gluten indicate clearly their high value for bread making purposes. There are, however, certain differences, and if placed in order of merit, Wheat No. 5, Percy, Ottawa, would stand first, with the same wheat grown at Indian Head (No. 1) a close second. Of the other three wheats, those grown at Indian Head, the order would probably be Red Fife and Stanley, equal, followed closely by Preston. In the Ottawa grown samples these three wheats show extremely small differences—the albuminoid data slightly favouring the Red Fife, while the Dry Gluten content similarly favour the Preston and Stanley.

(Sgd.) FRANK T. SHUTT,

Chemist, Dominion Experimental Farms.

*In comparing these gluten data with those obtained by the miller, the former will invariably be found higher, since they have been obtained upon the whole wheat meal, and consequently contain the elements of the bran and shorts absent in the floor.

In discussing these conclusions with an experienced grain buyer and miller, I am informed that the wheat of last year's crop from certain districts of the North-west is somewhat inferior in quality to that usually produced, and that this may be attributed to a check in the ripening of the wheat, which occurred a few weeks before harvesting, due to low temperatures ; in some parts the freezing point was almost reached.

WHEATS : PERCY, PRESTON, RED FIFE AND STANLEY

Grown on the Experimental Farms at Indian Head, N.W.T., and Ottawa, Ont., 1902.

No.	Variety.	Locality Grown.	Weight per Bushel.	Weight of 100 kernels.	Moisture.	Albuminoids.	Fat.	Crude Fibre.	Ash.	Carbo-Hydrates	GLUTEN.	
											Wet.	Dry.
			Lbs.	Grams.								
1	Percy	Indian Head. ..	62	2 828	11 50	12 50	2 26	1 79	1 47	70 48	38 10	14 78
2	Preston.....	"	63½	3 022	11 48	11 63	2 25	1 85	1 68	71 11	31 68	12 34
3	Red Fife...	"	62½	3 164	11 44	12 44	2 48	1 86	1 36	70 42	34 68	13 43
4	Stanley.	"	62½	3 019	11 08	12 41	2 42	1 88	1 44	70 77	37 48	14 18
5	Percy	Ottawa.....	62	3 551	12 05	13 56	2 14	2 09	1 91	68 25	41 59	16 64
6	Preston....	"	63	3 680	12 22	12 22	2 46	1 83	1 88	69 39	35 93	14 26
7	Red Fife...	"	61	3 302	12 79	12 41	2 43	2 02	1 84	68 51	34 35	13 55
8	Stanley.....	"	62	3 551	12 23	12 34	2 44	2 08	1 71	69 20	33 95	14 22

Laboratory, Central Experimental Farm,
OTTAWA, April 29, 1903.

(Sgd.) FRANK T. SHUTT,
Chemist, Dominion Experimental Farm.

CENTRAL EXPERIMENTAL FARM,
OTTAWA, May 14, 1903.

Report on 'Early Riga' Wheat, grown at Experimental Farm, Indian Head,
N.W.T., 1902.

Analysis.

	Per cent.
Moisture.....	11 09
Albuminoids.....	13 72
Fat.....	2 13
Crude fibre....	1 90
Ash.....	1 40
Carbo-hydrates.....	69 76
	100 00

Physical Data.

Weight per bushel.....	64 lbs.
Weight of 100 kernels.....	2 438 grams
Wet gluten.....	44 07
Dry gluten.....	16 70

Comparing these results with those of the eight samples reported on May 2, 1903, it will be noted :

1. That as regards moisture-content this wheat is very similar to those from Indian Head already examined. Their average was 11 37 per cent as against 11 09 per cent in the present instance.

2. That in albuminoids this wheat is slightly superior to the best of the series previously reported on, viz., the Percy. The figures are as follows :—

	Albuminoids.
Early Riga (N.W.T.).....	13·72
Percy (Ottawa).....	13·56
Percy (N.W.T.).....	12·50

As might be expected, the data for the wet and dry gluten are similarly higher than those of the Percy.

	Wet gluten.	Dry gluten.
Early Riga (N.W.T.).....	44·07	16·70
Percy (Ottawa).....	41·59	16·64
Percy (N.W.T.).....	38·10	14·78

Not only is the gluten satisfactory as to quantity, but also as to quality. In noting the character of the wet gluten, it was found to be slightly creamy in colour, firm, elastic, and of uniform texture—denoting a ‘strong’ flour and one eminently suitable for bread making purposes.

(Sgd.) FRANK T. SHUTT,
Chemist, Dominion Experimental Farms.

Ottawa, May 14, 1903.

Mr. Shutt does not find in the chemical analyses quite as large a difference in the proportion of gluten in the Early Riga, when compared with the Percy, as Mr. Julicher gives, but the difference is only a fraction of one per cent. Mr. Shutt found in Early Riga dry gluten, which he says is of very high quality, 16·70, while the Percy from Ottawa is 16·64, and the Percy from the North-west Territories is only 14·78. These have been determined in duplicate by very careful and accurate methods. Mr. Shutt says ‘not only is the gluten satisfactory as to quantity, but also as to quality,’ in all these three wheats. In noting the character of the wet gluten, it was found to be slightly creamy in colour, firm, elastic, and of uniform texture—denoting a strong flour, and one eminently suitable for bread-making purposes.

DEDUCTIONS FROM ANALYSES OF WHEATS.

From the facts I have submitted, it seems clear that of the samples which have been submitted to these experts, the two, each of Red Fife, Preston, Percy and Stanley, whether grown at Indian Head or Ottawa, are all good wheats for milling and for bread. Mr. Julicher puts the two Red Fife samples first, very closely followed by Stanley, which is a twin wheat with Preston, and contains a higher percentage of gluten than either of the Red Fife samples. Preston stands equal to Red Fife in proportion of gluten, but drops below it a little in point of colour of the dough, the Ottawa sample of Preston standing a little higher in that respect than that from Indian Head in Mr. Julicher’s report.

From the chemical analyses of the eight samples first named, Mr. Shutt puts Percy first in point of merit. It is shown to be richest in gluten, which accords also with Mr. Julicher’s statement, whilst Mr. Halliwell puts them as just equal with Red Fife. Between Preston and Red Fife, while the Red Fife is graded as highest in quality, the difference is small and the advantage the Preston has of ripening on an average of nearly four days earlier may possibly make up for any slight difference in the grade. Its earlier ripening habit is a great inducement to the farmer to put this variety in as part of his crop, provided he can get about the same price for it. A difference of two thirds of a cent per bushel, the actual difference in value on the English market, according to Mr. Halliwell, would not weigh with the farmer to any

great extent in this case. A proportion of these earlier wheats in his crop would enable him to begin his harvest about four days earlier, which would help him to save all his wheat in good condition, and with less loss either from shrinking or from shelling. In a recent letter from a prominent farmer in Assiniboia, he says: 'There is one thing I wish to say for your information. There are thousands of bushels of Preston wheat sold in the North-west Territories. It is sold as Red Fife. I am informed that nine out of ten buyers cannot tell the difference between Red Fife and Preston. A buyer was asked in W——— his opinion of Preston wheat. He said, 'I know nothing about Preston, I only buy Red Fife.' He was asked if he had purchased from Mr.———, and he said, 'yes, and I gave him the highest figure for his wheat.' He was surprised to hear that it was Preston. I grew Preston wheat this year; it was shelling out while my neighbour's Red Fife was green and frozen.' There must have been some difference, I think, in the time of sowing or there would not have been that great difference in the ripening. In Mr. Julicher's report on the second series of samples, I desire again to call the special attention of this committee to the high position he assigns to the Early Riga wheat. This report shows that it contains about 20 per cent more gluten than either of the samples of Red Fife, and that the gluten is equal in quality. This high gluten content is associated with a very early ripening habit, averaging, as already stated, during the past four years' trial, about 8½ days earlier than Red Fife. To find a wheat superior in quality to Red Fife, is what one would scarcely expect, but to find that superiority associated with so much earliness is both surprising and highly gratifying, as the originating and cultivating of such wheat will probably lead to an extension of the wheat-growing area in Canada further north than is possible with the varieties at present grown. This great gain in earliness is associated, as I have already pointed out, with a falling off in crop to the extent of two bushels and 35 pounds per acre on an average of four years. While the Preston has given an average on the trial plots at all the experimental farms during a period of eight years of 34 bushels 59 pounds per acre, and the Red Fife, 33 bushels and 20 pounds, the Early Riga has given during the four years it has been under trial an average of 30 bushels 45 pounds. If this wheat on further trial maintains its earliness, quality and productiveness, its general introduction will largely influence the future of wheat-growing in Canada. The outlook is most encouraging, and the results a triumph of the skill of the hybridizer.

In view of the great importance of this branch of the work at the experimental farms, and to provide for its continuance in a larger way, the Minister of Agriculture has authorized the formation of a special division of cereal breeding and experimentation, with Dr. C. E. Saunders in charge. It is the desire of the Minister to extend this work and to provide for its being done in the most careful manner. An important series of experiments has been planned and is being carried out for 1903, and the well known skill of the head of this Division in this difficult line of work will no doubt bring results which will be very valuable to this country. The civilized world is waking up to a knowledge of the immense wealth laid up in the enormous areas of fertile lands within the Dominion of Canada. Their vast extent is but imperfectly understood even among our own people. The investigations of explorers in Northern Ontario have outlined a fertile belt comprising in all about 16,000,000 acres, and this does not include the 1,000,000 acres north-west of Lake Temiskaming. A large part of this land is wooded and the process of breaking up such land is a comparatively slow one.

SOME OF CANADA'S VAST AREAS OF FARM LANDS.

As to the area of land fit for settlement in Manitoba, Assiniboia, Saskatchewan and Alberta, the following figures have been obtained from official sources and may, I think, be accepted as a rough approximation of the areas in question. Manitoba has a total area exclusive of water of 41,000,000 acres, of which it is estimated that

two-thirds, or 27,000,000 acres, are fit for cultivation. Assiniboia has a total area of 57,600,000 acres, of which probably $\frac{2}{3}$, or 50,000,000 acres are fit for settlement. Saskatchewan has a total area of 70,400,000 acres, of which about $\frac{2}{3}$ are said to be fit for cultivation, giving 52,000,000 acres. Alberta has a total area of 63,400,000 acres, $\frac{2}{3}$ of which are said to be fit for settlement, or 42,000,000 acres. From these figures it will be seen that there is believed to be about 171,000,000 acres of land fit for cultivation in Manitoba and the three provisional territories referred to. What proportion of the wide extent of country north and east of these, including the 60,000,000 acres of land in Athabasca, and a large area in the Mackenzie, is fit for settlement, is not yet known, but it is believed that a large portion of that vast country will eventually be settled.

Samples of wheat grown at Fort Vermillion on the Peace River, have been sent to me, some of which I have brought here to show you. This variety was sent under the name of 'Manitoba wheat,' I do not think it is Red Fife, but it weighed 64 pounds per bushel. This was grown 591 miles north of Winnipeg. I have also Ladoga wheat here which was grown at Fort Chippewan and samples of grain grown at Fort Simpson.

By the Chairman :

Q. This seems more like White Fife, after it has been grown a number of years in the country ?

A. Yes ; it has some resemblance to White Fife.

I have a map here and will point out where these samples were grown. This area here (outlining the boundaries of Manitoba and three of the provisional territories) embraces the 171,000,000 acres which I have referred to. This (outlining the boundaries of Athabasca) has about 70,000,000 acres more, of which very little is known. The Mission station at which the wheat was grown weighing 64 pounds to the bushel was at Fort Vermillion on the Peace river, in the upper part of the Athabasca territory. Fort Providence is on the Mackenzie in latitude 60° 70' and about 710 miles north of Winnipeg. Fort Simpson is still further north, somewhere up towards the middle of the Mackenzie River district, 818 miles north of Winnipeg. This is the furthest point north from which I have received samples of grain. From the facts I have submitted to you, it is evident that the possibilities of wheat growing in Canada are enormous, and large areas of the more northern portions of the country will no doubt furnish a vast amount of land suitable for ranching and mixed farming. I thought you would be interested in seeing the wheats produced at these far distant points, and I am informed now by people who are familiar with that country that while ten or fifteen years ago the few settlers there were entirely dependent on the Hudson's Bay Company for supplies and paid from \$10 to \$15 a hundred for flour, that now sufficient wheat is raised there to more than supply the home demand. There is a flour mill at Mission River on the Peace river, and appliances for grinding wheat at several other places, so that the flour used by the people residing there is almost entirely supplied from home-grown wheat.

By Mr. Stewart :

Q. Are Preston and Early Riga bald wheats ?

A. Preston is a bearded wheat, but the Early Riga is a bald wheat.

Q. Is the straw good and stiff, does it stand up well ?

A. Yes.

Q. As well as the Red Fife ?

A. I do not think the Early Riga has quite so stiff a straw as the Red Fife, but it stands well. The superintendent of the Brandon Experimental Farm reports it as having a stiff straw while it is said to be medium at Indian Head. The Preston is much the same as Red Fife in this respect.

Q. The stiffness of the straw and how the wheat will handle in the binder is very important.

A. Yes, of course it is, but the Preston is without fault in that respect and I think the Early Riga will also be found fairly satisfactory.

By Mr. Henderson :

Q. Can you tell us with regard to the district where this sample of wheat was grown at the Peace River Mission, which gave 64 pounds to the bushel. During the past ten years how many of these years have they been troubled with frost ?

A. I regret I cannot answer that question, and I do not know where such information could be had as yet there are only a few settlers in that country and they are mostly interested in ranching. They grow enough wheat for their own use, but they have no object in growing it largely because they have no facilities for sending it out of the country.

Q. You are not sure whether or not the country is quite free from frost for wheat-growing purposes ?

A. I am not sure. An expedition has been sent there this season in connection with the Geological Survey, under Mr. James M. Macoun, which will, I hope, give us a much better general knowledge of this country. In the past nearly all we have known about this country has been learned from boat journeys on the rivers ; hence our knowledge is mainly confined to the river valleys. This expedition is to take horses from Edmonton and travel from Edmonton on horseback and camp at different points and explore for a radius of 100 or 150 miles in all directions, and get all the information possible in reference to the country and its possibilities. I hope, when that expedition reports in the autumn, we shall know much more than we now do about the Peace River country. In the meantime, we have an enormous area of land to fill up, of which as yet only 3 or 4 per cent has been brought under cultivation.

CLIMATIC CONDITIONS AFFECTED BY SOIL CULTIVATION

By Mr. LaRivière :

Q. Do you know that the extensive cultivation that has been done in the Northwest and Manitoba has done a great deal to prevent early frosts and to moderate the climate ?

A. I feel quite satisfied that cultivation has had the effect of lessening frosts, although it is a difficult thing to prove. It seems only reasonable that it should do so. When the prairie soil is broken up and the black cultivated surface is exposed to the heat of the sun, that black soil will absorb a very large quantity of heat from the sun's rays every day and give it out gradually when night comes and the temperature lowers, and the giving out of that surplus heat, which has been absorbed during the day, over a very large surface will no doubt lessen the probability of frost. The area of cultivated land in Manitoba does not yet amount to one-tenth of the whole tillable area, which is not a very large proportion, but so far as one can judge—and I have watched the results for a good many years, and it seems evident that the climate has been tempered in such a way as to make frost of late very much less frequent than in the past, and I think that the danger from frost will be less as the proportion of cultivated land is increased.

MR. LARIVIÈRE.—I may say that that is my experience. I have been thirty-two years there, and I remember that during the first few years we had a good deal of trouble with the early frosts in the fall, particularly in the last week in August. But during the last few years, in the most settled portions of the province, we have heard nothing about these frosts in August, so that the climate must be influenced a good deal by the extensive cultivation now made, and I think, while there might be some objection at present with regard to early frosts in the Peace River districts, when the country is opened up and cultivated, we would have the same results there as in Manitoba and the West to-day.

THE WITNESS.—In confirmation of that, I may say that we have had, within twenty-five or thirty years, much the same experience in the northern portions of Ontario. I re-

member distinctly that in the counties of Grey and Huron and other adjoining counties in Ontario, frost at that time often destroyed considerable portions of the crops, and if farmers escaped frost in the spring up to a certain time, their crop was considered safe, but frost was always an element taken into consideration by the farmers at that time. Of late years we have heard little or nothing of such conditions. I think this change must be due to the clearing of the land and the breaking up of the dark soil, which absorbs the heat during the day and then gives it off again gradually, as the cooler temperature of night comes on.

WHEAT GROWN IN HIGH NORTHERN LATITUDES.

I might say that these samples of grain we have been discussing, from the Mission on the Peace river, were sown on May 7 and harvested on August 27. This, as I have already stated, is 595 miles north of Winnipeg.

By Mr. Henderson :

Q. That is north of the latitude of Winnipeg ?

A. Yes. Fort Simpson is 818 miles north, and the grain there was sown on June 7 and harvested September 22, indicating that early frosts did not occur there that year. This Fort Simpson wheat weighs 62½ pounds to the bushel. It has a very plump grain, but it has the appearance of being partly frosted. The samples are here for your inspection.

This completes what I had to bring before the Committee in regard to wheat this morning, unless any member desires to ask me any questions.

By Mr. Henderson :

Q. These were samples of Red Fife you have just been speaking of that you got from the far north ?

A. No, in most cases they were Ladoga.

Q. That from Fort Simpson was Ladoga ?

A. Yes, one of the samples from Dunvegan, a mission station on the Peace river, may be Red Fife, it seems to be plumper than Ladoga. At the time when the late Lieutenant Governor Schultz was holding sessions of his commission in reference to the Mackenzie River district I was asked to send to all the Hudson Bay Company posts samples of the earliest ripening wheats to see if they would grow there. I sent Ladoga and Onega, but I considered Red Fife too late in ripening for those districts. I am told that the wheat chiefly grown there now is the Ladoga, which ripens about a week earlier than Red Fife. It makes a yellowish tinted flour, which our millers here, with good reason, object to, as a white flour is what our best customers want. But when one is living so far from civilization as the Peace river, a slight shade of yellow in the flour is not objected to and any wheat which will produce flour of good quality and good flavour is appreciated.

TESTING THE GERMINATING POWER AND PURITY OF AGRICULTURAL SEEDS.

The next thing which I wish to bring before you is the work we have done at the Central Farm in testing the vitality of cereals and other agricultural seeds during the past few months. This useful work, as most of you know, has been carried on, every year, since the experimental farms were established. For the first four years the average number of samples tested was 790 per annum, but for the past twelve years the average number has been 2,015 each season. They have consisted largely of samples of cereals, the vitality of which was doubtful owing to bad harvest weather or to some other unfavourable condition. Many samples of timothy, clover and other seeds which farmers were buying and wanted to know whether they were good, have also been sent for test. The total number of samples which have been tested and reported on since

this work was begun is 29,451. Farmers are invited to send in every year any samples which may be of doubtful vitality through injury in harvesting or storing, so that their germinating power may be determined and their usefulness for seed purposes ascertained. They are also invited to send samples of any agricultural seeds which they propose to purchase, so that their purity and vitality may be known. In 1902, the number of samples tested was 1,830. During the present year the number has been 2,103. Among these there were 131 samples of clover seed, which have averaged 75·7 per cent in germinating power. While many of the samples have gone as high as 80 to 90 per cent, only seven samples have fallen below 50 per cent. Seventy-five samples of timothy have averaged 83·4 per cent, showing that in these important staple seeds, while we may meet with an occasional bad sample, the Canadian seedsmen, as a rule, have supplied farmers with a very reliable quality of seed and most of the samples have been remarkably clean.

Closely associated with this branch of work is the study of the length of time during which grain and seeds of different sorts will hold their vitality. In many instances the decrease in vitality by age is much more rapid than is generally supposed. In 1898, some experiments were begun in this direction by the selection of twelve samples, all vigorous growing sorts and all from the crop of 1897. Each of these samples was placed in a cotton bag and stored on an open shelf, on the shady side of the room in an ordinary office building, midway between the floor and ceiling, where they would get as equal conditions of temperature as could be had. They were kept in this way and tested every year. The samples consisted of three different sorts of wheat, four of oats, two of barley, two of pease, and one of flax seed. The wheats were samples of Red Fife grown at Indian Head, and Preston and Red Fern, both grown at Ottawa. The oats were Banner, grown at Ottawa and Indian Head, one sample of Prize Cluster, grown at Ottawa, and one sample of Scottish Chief, a variety we were growing then, but have since discontinued. This was grown at Indian Head.

In wheat the average percentages of vitality for the three varieties taken from the crop of 1897, during the five years test stands as follows: in 1898, the samples averaged 80 per cent of vitality; in 1899, they averaged 82·3 per cent, a slight increase; in 1900, they dropped to 77·3 per cent; in 1901, to 37 per cent; and in 1902, the percentage of vitality was only 15 per cent. I might say that the 15 per cent of vitality, in 1902, is entirely made up by Red Fern, Red Fife and Preston, having lost their germinating power altogether and not a single kernel would grow at the end of five years. So you see the stories of wheat growing which has been taken from mummies cannot be entertained as true, they are probably the result of imposition on the part of Arabs, on too credulous travellers.

In oats the average percentage of vitality for the four samples during the five years' test stood as follows: in 1898, it was 90·2 per cent; in 1899, 93 per cent; in 1900, 72 per cent; in 1901, 67 per cent, and in 1902, 54 per cent. In no instance have oats entirely lost their vitality, yet it has fallen on the average in five years to about one-half. Of barley, two varieties were chosen, one a two-rowed sort known as Canadian Thorpe, grown at Indian Head, and the other, a six-rowed variety, Mensury, grown at Ottawa. The average percentage of vitality of these two barleys during the time they have been under trial has been as follows: 1898, 97 per cent; 1899, 91 per cent; 1900, 78·5 per cent; 1901, 36 per cent; 1902, 19·5 per cent. The two-rowed variety has entirely lost its vitality within the last year while the six-rowed have retained 39 per cent, which makes up the average figure given.

By Mr. Erb :

- Q. How does the average of the two-rowed compare with that of the six-rowed ?
 A. As a rule, the six-rowed run the highest.

By Mr. Henderson :

- Q. Would you recommend a farmer to grow last year's wheat, instead of this year's ?

A. I would advise a farmer that it would probably be quite as good as this year's seed for sowing.

Q. It looks better, from that table you have read, the second year than the first ?

A. Yes, it looks better ; but the figures given are only the average of a few samples. We should like to have a much larger number on which to base conclusions. As far as our experience has gone, there is no loss of vitality in grain kept for one year, and a farmer may expect as much vigour in a crop grown from such grain as if it were sown the first year ; but in the third year there is a slight falling off, and in the fourth and fifth years there is a rapid decrease in vitality, so much so as to make them quite unfit for seed. We have tested samples kept over from different exhibitions, and where they have stood over ten years, we have found, as a rule, that they have quite lost their vitality.

By Mr. Erb :

Q. The seeds you have put away, I suppose, were only put in ordinary bags ?

A. In ordinary cotton bags.

Q. You have never tried to see if there was any difference if the seeds were placed in an air-tight vessel ?

A. Most of the samples from exhibitions that I have referred to as having been kept for ten years or more, were kept in bottles. This year we have set aside a large number of samples, so as to extend our knowledge in regard to this line of work in the future, and I hope in a few years to be able to give fuller details regarding this interesting subject.

Q. Have you made any experiments to determine the vitality of root seeds, such as turnips and mangels ?

A. We have not. Two varieties of pease were tested, Daniel O'Rourke and Large White Marrowfat. The average percentage of vitality shown by these two varieties was as follows :—In 1898, 94 per cent ; 1899, 95 per cent ; 1900, 88 per cent ; 1901, 64 per cent ; 1902, 64 per cent. A sample of flax was also tested, a single example. This was included in the test I have referred to, and gave, in 1898, 81 per cent ; in 1899, 82 per cent ; in 1900, 75 per cent ; in 1901, 49 per cent, and in 1902, 26 per cent ; all bearing out the statement made, that after four or five years there is a rapid decline in vitality.

From these tests we gather, that when any of the varieties of grain or seed referred to are kept over for sowing, they may be expected to be about as high in germinating power and in vigour of growth the second year as they were the first. In the third year there is a slight falling off, and in the fourth and fifth years, a rapid decline in proportion of vitality.

By Mr. Richardson :

Q. Would not the temperature at which these samples are kept be just as likely to injure the vitality as the exposure to the air ?

A. It would be very difficult to answer that in the absence of facts. In the experiments begun this year, we have made good sized mouse-proof boxes with shelves, and put them in a granary, where the temperature is fairly uniform. Other samples have been put in the office already referred to, a building adjoining the greenhouses, and a third lot in the garret of one of the houses on the farm, where they will be exposed to fairly low temperatures during the winter. From tests made under these different conditions we hope to gain much useful information.

By Mr. Leblanc :

Q. We are under the impression down east, that in sowing the same kind of grain for several years in succession, the crop will be inclined to diminish each year, and that if we can possibly get our seed changed, bring it, say, from 20, 40 or 50 miles distant, that it will do much better. I think I can safely say, we have tried it, and the

experience has been that it is better to change any kind of seed, even potatoes. I would like to have further information on this point ?

A. I think that the conclusion you have reached is quite correct. It is the prevailing impression, and I think that impression has been gained from actual experience, but it is a very difficult thing indeed to prove. If a change of seed is made and you get a better crop you cannot tell how much of that is due to the seed, or how much to the condition of the land or to the season, but, where we have a consensus of opinion of farmers all over the world, that such is the fact, it is pretty safe to conclude that that impression is founded on experience. We have, however, experienced exceptions to that rule. We have sent to the North-west and brought seed to Ottawa and sometimes we have not had as good results as we have obtained from grain which has been growing here for a good many years. Possibly a change from such widely distant points may not be as favourable to good results as though the seed came from a nearer district. I think the changing of seeds from one soil to another and from one district to another helps to maintain the vigour and character of the crops to a large degree.

By Mr. Henderson :

Q. We get a different report from the Guelph Agricultural College and even your own reports, demonstrate that the contrary is the fact, that by a constant system of selecting the heads, and continuing the selection year after year and sowing the same grain on the same soil, better results have been obtained. That is my recollection of what we were told here some two or three years ago, and the reports were given to bear out those facts of experiments extending over six or eight years ?

CROP RETURNS FROM SELECTED AND SCREENED SEEDS.

A. That is another aspect of the same subject, but under different conditions. What I have referred to in the remarks I have just made were the ordinary crops of the ordinary farmer. When we get our grain carefully selected by hand, choosing the finest heads and growing crops from such selected seed, year after year, on experimental plots, we have found a fairly steady increase; that is the past four years have given us better crops than the previous four years. How much of this is due to the selection, how much to the better condition of the soil, because we are looking after that all the time, and how much is due to the season will, I think, be impossible for any one to prove. What we want to give is actual facts, and to explain the conditions under which we are working and with enlarged experience we may be able to generalize in the future with much more certainty than we can now.

Q. I do not pretend for one moment that I have ever understood that sowing the same seed grain year after year was a good thing, but that if you make a good continuous selection year after year and picking out always the best heads and getting the very best matured grain as seed grain for the succeeding year, but is it not a fact that at Guelph they published reports that demonstrated that under that selection of seed better results are obtained ?

A. They have, I believe, obtained good results there, from this method, and we have also obtained good results here, but how much of this is due to one agency and how much to another is a difficult point to establish. With your permission I will give you the results with seed from selected heads as compared with screened seed.

Q. I was just going to ask you how many years you have been experimenting in that way ?

A. During the past three years some experiments have been carefully conducted at the several Dominion Experimental Farms to gain information as to how crops from seed of selected heads would compare with those grown from screened seed, so screened as to leave only the plump and well matured kernels. In each case the selected seed has been obtained by gathering the largest heads and the well screened

seed from unselected grain. Both have been sown alongside of each other, and under similar conditions.

At the Central Experimental Farm at Ottawa, in 1900, eight varieties of wheat were tested in this way ; that from the selected heads produced 32 bushels to the acre, and the average from the screened seed was 29 bushels 7½ pounds, a difference in favour of the selected heads of 2 bushels 52½ pounds. Ten varieties of barley were treated in the same way in that year, and the average from the selected heads was 53 bushels 1 pound to the acre, and from the screened seed, 49 bushels 11 pounds.

By Mr. Bell :

Q. Do you use the whole of the grain from the selected heads, or do you screen that ?

A. We screen the grain from the selected heads and sow the larger kernels. In these tests with barley there were 3 bushels and 38 pounds in favour of the selected seed.

At the Brandon Experimental Farm, in 1900, five varieties of wheat were treated in this way, and from the selected heads there was an average of 20 bushels 8 pounds to the acre, and from the screened seed, 20 bushels 58 pounds, or 50 pounds to the acre in that case in favour of the screened seed. It is probable that the season and perhaps some other factors came in there, which influenced the result. Three varieties of barley were tested the same year, and the selected heads gave an average of 34 bushels 1 pound to the acre, and the screened seed gave 35 bushels 20 pounds, making in that case a difference of 1 bushel 19 pounds per acre in favour of the screened seed. At Agassiz, in the same year, eight varieties of wheat gave, from selected heads, 25 bushels 46 pounds, and from screened seed, 23 bushels 41 pounds, a difference in favour of the selected heads of 2 bushels 5 pounds.

Ten varieties of barley at the same farm produced—

From selected heads..	36.31 bushels per acre.
From screened seed..	28.2 “

Showing a difference in favour of the selected heads of 8 bushels and 29 pounds per acre.

In 1901, 34 varieties of wheat were sown at Brandon with seed from selected heads, and the same number from screened seed, growing side by side, and the average of the whole gave 9 pounds per acre in favour of the screened seed. From the 34 varieties of wheat the average yield was—

	Per acre.	
	Bushels.	Pounds.
From selected heads..	32	39
From screened seed..	32	48

In favour of screened grain, 9 pounds.

Experiments in the same year at Brandon with six varieties of barley gave—

	Per acre.	
	Bushels.	Pounds.
From selected heads..	32	16
From screened seed..	30	32

A difference in favour of the selected heads of 1 bushel 32 pounds per acre.

At Indian Head, in the same year, one variety of oats, Banner, gave—

	Per acre.	
	Bushels.	Pounds.
From selected heads..	130	20
From screened seed..	122	12

In favour of selected seed, 8 bushels 8 pounds.

Taking the whole series of experiments, 123 in all, 96 with the wheat, and 37 with barley, covering a period of three years, the average gain from the use of grain from selected heads has been a little less than $5\frac{1}{4}$ per cent.

This is a large increase and the results obtained should induce many to adopt this practice. Not only does it bring an increase of crop but since only well-developed and typical heads are chosen the variety is preserved true to name and free from foreign admixture.

By Mr. Henderson :

Q. Were these heads selected from the crop of the previous year that was grown on the same land ? Did you continue a series of experiments always selecting from grain produced on the same land ?

A. Sometimes they were selected for several years in succession. The screened grain was usually from the ordinary farm crops. Where the same varieties are grown for a number of years in succession it is the practice to change the soil so that the same land will not be occupied by the same crop oftener than once in three years.

By Mr. Richardson :

Q. Have you made any experiment with screening the grain from the selected heads, first selecting the heads, and then screening the grain.

A. That has been our practice here for some years past. We first pick the large heads, thresh them and screen the seed so as to use only the larger kernels.

By Mr. Robinson (Elgin) :

Q. What would be the cost of selecting these heads ?

A. We find that it takes six or seven pounds of plump heads to furnish sufficient screened seed for one of our plots of one-fortieth of an acre. This takes a careful man about an hour. At this rate it would take about four days of a man's time to pick a sufficient quantity of heads to furnish the seed required for an acre of land.

By Mr. Henderson :

Q. If a farmer has to drive twenty-five miles to get a change of seed every four or five years, and if he continues without selecting, he requires to change every four or five years, I presume he would make the selection at about the same cost as it would require to drive away and get a change of seed and pay another farmer five or ten cents a bushel more for it than the market price. To my mind, the cost of selection would be a very trivial thing compared with the advantage derived ?

A. You are quite right, $5\frac{1}{4}$ per cent is a large increase and it would well pay any one, I think, to go to the labour of selecting the heads in order to get that increase, but unfortunately the labour of selecting heads comes at a time when the farmer wants to get at his harvest and he is very apt to put it off.

MR. HENDERSON.—A man may select two bushels from a ten-acre field of well-matured heads. He sows that two bushels the next year and makes a selection again. Let him continue that for several years, and then he probably has, say, thirty, or forty, or sixty bushels of good grain, and he can sow this sixty bushels that he has obtained from special selection. To my mind, the matter of cost is rather exaggerated, when you compare it with the gain.

By Mr. Beith :

Q. The men, in selecting the heads, would trample down the grain ?

A. Yes, to some extent, but I think the increase of $5\frac{1}{4}$ per cent well worth looking after. As a matter of fact, in almost every farming community a large proportion of the best seed for that community is provided by a few of the most advanced farmers. It often happens that one man has a dirty field, with weeds which he desires to get rid

of, and he prefers to buy from some neighbour who has a clean farm, and I suppose that out of every hundred farmers in the Dominion there are perhaps five or ten who supply the bulk of the seed, whenever there is a change made in the district, owing to their reputation for having clean farms and clean seed. If these farmers could be induced to take an interest in this subject and to do this work of selecting heads, it would, I think, be an excellent thing for the crops of the country.

DISTRIBUTION OF SEED GRAIN.

I desire to call attention for a few moments to the distribution of seed grain. This useful branch of the work of the experimental farms has been continued and is greatly appreciated by farmers everywhere. When I had the pleasure of appearing before you last year, the distribution for 1902 was in progress. When completed, it figured up 37,408 samples sent out from the central farm and 6,493 from the branch experimental farms, a total of 43,901 samples, or over 70 tons of the very best sorts of seeds obtainable.

I may say, that in distributing this grain, we are very particular to have it clean. First of all, it is passed through a fanning-mill, the best that can be got, so as to leave no weed seeds, and after that, there are many thousand pounds picked by hand, in order to remove any weed seeds or grain of some other sort that may have got into the sample and which cannot be removed in any other way. The greatest care is exercised to send the grain out perfectly clean. Hundreds of letters are received every year from farmers, expressing their gratitude for the samples sent, as in this way they obtain, at no cost beyond their own labour, pure seed of the highest quality. In this way many of them have produced sufficient seed for their own sowing and a surplus to sell to their neighbours.

Last year, over 40,000 farmers received samples of grain for this good work, and there is no doubt that the quality, character and productiveness of seed grain throughout the entire Dominion has been influenced very largely by the placing of these comparatively small quantities in the hands of good men. This work has been done by the farmers, partly for the sake of having good grain themselves, and partly for the sake of having good seed grain to sell to their neighbours at a good price.

During the past eight years, from 1895 to 1902, inclusive, the number of samples distributed annually has averaged 36,684, and the total number sent out since the distribution was begun in 1888, is 387,898, involving the use of over 581 tons of first-class material for this purpose. Of these samples, 338,609 have been sent out from Ottawa, and 49,289 from the branch farms.

During the season of 1903, just closed, the distribution has been somewhat modified. Last year I explained to the Committee that we were carrying on two classes of distribution, one where we were sending out three-pound samples of wheat, barley or oats, and the other where we were sending out eight pounds of oats or ten pounds of barley or wheat. The object of this larger distribution was to supply enough seed for one-tenth acre plots, so as to get a return of the yield per acre in the different parts of the Dominion from these respective varieties. The sending out of a limited number of these larger samples was carried on for three years and did great good in interesting farmers in this work. But it led to some dissatisfaction, in this way : One man would find out that his neighbour had got ten pounds of seed, and he had only got three pounds, and we were suspected of favouritism. This year it was thought best to put the applicants all on the same footing as regards the amount of seed sent out.

By Mr. Henderson :

Q. Do you make them all tens ?

A. Not all tens, but all fours and fives. We could not get the grain in sufficient quantities of pure quality to send out ten-pound samples to all. The size of the plots on which applicants are requested to grow this grain have been reduced from one-tenth

to one-twentieth of an acre, and we have sent every one, this year, four pounds of oats or five pounds of wheat or barley, sufficient to sow a plot of that size, so that when the returns are made, we may have the particulars of information desired.

The number of samples sent out this season was 29,671. Of these, Ontario got 6,931; Quebec, 11,393; Nova Scotia, 3,031; New Brunswick, 2,637; Prince Edward Island, 1,065; Manitoba, 1,926; North-west Territories, 2,294, and British Columbia, 394.

CORRESPONDENCE.

The correspondence maintained with the officers of the farms by the public is also an indication of the great use which is being made of the experimental farms by the farmers of Canada. This correspondence has assumed very large proportions. At the Central Farm alone, during the past six years, 305,840 letters have been received, or an average of 50,973 per year for the six years. Reckoning the working days in the year at 310, this is an average of 160 letters a day for the whole period. This branch of the work seems to be steadily growing. In 1901, the total number of letters received at all the farms was 59,461. In 1902, the number was increased to 73,317. During the first three months of 1903, from January 1 to March 31, the total number of letters received at the central experimental farm was 27,664, so that the year has made a good beginning in that way. A large number of these are applications for grain, but a very large number, also, are letters asking advice in regard to the treatment of crops and what shall be done at this or that particular juncture. Before the recent rains came, we were getting letters asking what kind of late crops the farmers could grow to advantage to furnish food for their cattle in the autumn. Suggestions on many different topics are asked for and responded to, and thus a constant stream of information is going out from these farms to farmers, helping them in their endeavours to turn their crops to the best advantage and to make their work more profitable. The number of reports and bulletins sent out each year for the past six years has averaged 216,034.

VISITS TO THE BRANCH EXPERIMENTAL FARMS.

During the year, I have made visits to the branch experimental farms, and they have been all carefully inspected. These institutions are doing good work in the several provinces and territories where they are located, and are greatly appreciated. At Nappan, in Nova Scotia, the results of the experiments with dairy cattle, in the feeding of steers and swine, and in the growing of field roots and fodder crops have been very useful to the farmers of the Maritime Provinces. Much useful and helpful information has also been given in the report of the Horticulturist as to the growing of fruits and vegetables suitable for Nova Scotia.

The past year has been a favourable one for grasses and clover, and the cultivated grasses produced abundantly. Wild hay has yielded well. At the Brandon Farm, in Manitoba, 24 acres of Brome grass averaged two and a half tons per acre, while at Indian Head the crop varied from two to three tons per acre. Experiments in the feeding of steers have again demonstrated the value of Brome grass hay in that regard, and experimental work in the growing of grain has also been most instructive and valuable.

At all the farms experiments have been conducted with many different sorts of vegetables to find out which are best adapted to the climatic conditions prevailing where these different farms are located.

Many excellent varieties of fruits have been introduced to the fruit-growers of British Columbia through the work of the branch experimental farm at Agassiz.

By Mr. Boyd :

Q. What success have you met with in the growing of clover in Manitoba and the North-west Territories ?

A. In the growing of clover in Manitoba and the North-west Territories we have found that we cannot grow it in the way it is grown in the east, that is by seeding it down with the grain. The grain during its growth takes all the moisture out of the soil leaving little or nothing for the clover, and the result is that the young plants generally die out before the harvest. We have had, however, much success where the land has been entirely devoted to the clover for a season sowing it generally in the latter part of May. This has been tested in connection with summer-fallow with the object of ascertaining how far the land might be improved in fertility by the ploughing under of clover. These experiments have been carried on for three years, but as yet we are not able to detect any advantage in the ploughing under of clover, simply for the reason that the soil is so filled with plant food, and has such an abundance of nitrogen in it, that the addition of clover is practically without result. The nitrogen and humus given to the soil by the ploughing under of clover will no doubt eventually prove beneficial. It is proposed to continue these experiments, and in 20 or 25 years we may be able to detect a gradual lessening of the crops due to partial exhaustion. There is little doubt that there is a lessening of the crops on land long in cultivation in the Portage Plains, as they do not now produce there as high an average as they formerly did, there is no doubt that in the course of time the rich lands in other parts of Manitoba and in the North-west Territories will be so far drained of its superfluous plant food that the use of clover may be demonstrated to be exceedingly valuable, as it has been in the older provinces. In the meantime we are trying to get all the information we can as to the best methods of growing clover and the best methods of treating the land so as to get the best possible results from it.

Q. What varieties do you think may be grown there ?

A. The common red clover has succeeded very well, and we have also succeeded fairly well with Alsike.

Q. Possibly you know the impression prevails that the ordinary red clover will not succeed there ? that it gets killed by the frost and is not suited for that country ?

A. Yes, that impression is very common, and it is largely founded on the fact that it has often died out when grown with grain as a nurse crop. It is not likely that clover can ever be treated in the west, as it is in the east by sowing it with grain and ploughing under in the autumn, so as to form a useful addition to the plant food in the soil, but possibly by substituting the clover crop for summer fallow every third year, it may be shown in time that this is a very advantageous plan for the farmer to adopt. Instead of leaving the land in fallow a crop of clover can be grown on it in the spring and turned under in the autumn.

ORIGINATING NEW VARIETIES OF FRUITS ADAPTED TO THE NORTH-WEST.

The experiments we have been conducting in the growing of fruit in Manitoba and the North-west have been continued, and this year I have been able to distribute to 197 different points to people, who are known to be very much interested in this subject, young trees of some of the best varieties which have been produced by cross-fertilizing the Siberian crab. These trees will, I believe, be perfectly hardy in all the settled parts of Manitoba and the Territories. This gives you an idea of the increase in size (illustration produced) which has taken place from the cross-breeding. There is the original crab and of these are the actual sizes of the apples that have been produced, they are large enough to prove useful for the people. They can be used for the making of apple sauce, pies and jellies, although they are not, of course, equal to the apples from Ontario. Other lines of experimental work are being followed in this connection. These improved forms are being recrossed with such apples as Spy, Ontario, King, &c., with the object of increasing the size and improving the quality and keeping character of the fruit. The seedlings from these crosses will in all probability give larger sized fruits. Whether this second crossing will interfere with their hardiness or not has yet to be tested. The first crosses have been tested and have

proven perfectly hardy as far as we have gone. In choosing the points at which they have been placed for test this season the question of altitude as well as latitude has been considered and the locations chosen vary from 700 feet up to 4,200 feet, above sea level. These trees have been distributed to 92 points in Manitoba, 96 in the Territories and to 16 in Northern Ontario. Northern Ontario is entitled to consideration in this way, because farmers there have much the same climatic difficulties to contend with as they have in Manitoba.

By Mr. LaRivière :

Q. Have any attempts been made to cultivate the wild plum tree ?

A. Yes, we have been growing large quantities of these at Brandon and Indian Head and distributing them among the people. Wherever we have been able to find good varieties of the wild plum, we have purchased fruit in the autumn and had them sent to Brandon and Indian Head, saving the seed and planting it. This has been done whenever we have been able to find a good variety.

Q. There are one or two good sorts in my riding, good plums ?

A. I should be glad to have information where they are to be had, so that I may be able to grow young trees from the seed and distribute them among the farmers.

By Mr. Boyd :

Q. Is there any way of crossing these plums ?

A. Yes, we are carrying on similar experiments with plums to those I have described in connection with the apples. There are two species of wild plums in cultivation in this country, the American plum, *Prunus Americana*, and the *Prunus nigra*. The *nigra* is the form found in Manitoba, and it is also found about Ottawa and in Northern Ontario, but in Western Ontario the other form of plum, *Prunus Americana*, is the prevailing form, and the seedlings of both these forms vary much in colour and quality. These two plums differ in time of ripening, the *Americana* being considerably later in ripening than the *nigra*. Both of them are equally hardy. We have tried many varieties of both at the farms at Brandon and Indian Head ; and the American plums seldom ripen, the frost taking them before they are fit for use. The varieties of *nigra* ripen much earlier and are very useful plums. Occasionally a season occurs when the coming of frosts is delayed, when the American forms of plum ripen well, and then growers are delighted with them, as they are usually larger and better in quality than the plums of the *nigra* group. Such seasons, however, do not often occur. Our efforts for the last three or four years have been directed to finding the earliest and best forms of the *nigra* plum, many of which have been grown and distributed among farmers in different parts of Manitoba and the North-west Territories. In most instances these early ripening sorts escape the frosts and give good satisfaction. We are gradually increasing the number of the earlier ripening sorts and eradicating those which are late, but are leaving enough of these latter for further trial. Experiments are also being made in crossing the varieties of *nigra* with the better forms of *Americana*.

Some work is also being done with cherries. We are trying to cross the pin cherry, *Prunus Pennsylvanica*, with some of the cultivated sorts. It has been worked on for three or four years without success ; still, we hope eventually to succeed. Satisfactory crosses have been made between the sand cherry and plum.

INQUIRY AFTER CANADIAN FRUITS IN EUROPE AND ASIA.

The attention which has been called to Canada and to the fruits of Eastern Canada of late years has been very gratifying and has led to very widespread information throughout the world as to the quality of our fruits. I have already called your atten-

tion to the fact, that some varieties of Canadian oats have been grown for the last three or four years in Scotland, particularly the Banner, and much interest has been created in favour of Canadian-grown varieties, and there is a large demand in Scotland and England now for seed of the Banner, which is being supplied by our larger seed dealers. These oats are popular, for the reason that they adapt themselves to different conditions of soil and climate more readily than other oats do, and hence give better average results than the best oats they have been growing in the past. A few bags of the best sorts of Canadian spring wheats have also been forwarded to Great Britain, for the purpose of finding out whether any of these wheats are adapted to their climate and whether they can thus improve the quality of the flour made from home-grown wheat.

I was rather surprised, this season, to receive a letter from a large wholesale house in Liverpool, asking me to send some of our best Canadian apple trees to Jaffa, in the Holy Land. There was a fruit-grower there who was cultivating fruits in a large way, and he had heard of Canadian apples and was willing to pay any price in order to get a few young apple trees from Canada. I had a nurseryman forward these trees to Jaffa, through the Liverpool house, and I expect to hear later on that in the Holy Land apples have been established from Canada.

Early this season, I had a letter from one of the northern islands of Japan, inclosing a long list of Canadian apples and pears which it was desired to introduce there, and asking for scions of these different sorts for grafting. There are some good experimental farms now established in different parts of Japan. A letter was also recently received from Port Arthur, in China, from a Russian officer who has charge of tree-growing there for the Russian government, in which he sent a draft to cover the cost, asking to be put in communication with nurserymen here who would send him a supply of these noted Canadian varieties of fruit to test at Port Arthur, in China.

I mention these things to show that the fame of Canada is spreading.

Within the past few days we have had with us the lieutenant governor of the Orange River Colony, in South Africa, who has come to Canada mainly for the purpose of inquiring into our methods of farming and our system of experimental farms. Canada has the reputation in Europe of having the best and most practically helpful institutions of this sort to be found in the world.

MR. BOYD.—I believe Dr. Saunders' communication in regard to the ripening of the wheat earlier, so long as he can keep up the quality of it, is the greatest success, so far as value to the country is concerned, of anything I have heard in all the addresses I have listened to with so much pleasure from him. To estimate the value of that experiment to Canada would be indeed a difficult thing to do, and I trust it will be continued to the fullest possible extent.

DR. SAUNDERS.—I am much obliged to the Committee for their cordial expression of thanks. I can assure you that no effort shall be spared in trying to solve the problem of early ripening grain for the northern parts of the Dominion and of producing for the settlers there supplies of fruit that will be sufficiently good to add to the comforts of their homes and assist in making them a contented and happy people.

By Mr. Henderson :

Q. I would like very much indeed if you would continue the experiment of selecting the seeds, which, I understood, had been carried on for some five or six or seven years on the farms, and be able in another year to bring down a report showing the gradual increase, if there is an increase, from seed that has been selected, as compared with the old-fashioned system of changing the seed every four or five years.

A. I shall be very glad to continue these experiments and gather all the information I can for the information of the Committee and submit the facts.

Q. Facts are all we want.

Before I conclude, I wish to refer to another instance of the attention which is being paid to the progress of experimental work in Canada. There was recently a half-column reference in the London *Daily Times* in reference to the value of the cross-breeding experiments in fruits which are being carried on in Canada.

Having read over the preceding transcripts of my evidence, I find them correct.

WM. SAUNDERS,
Director of the Dominion Experimental Farms.

